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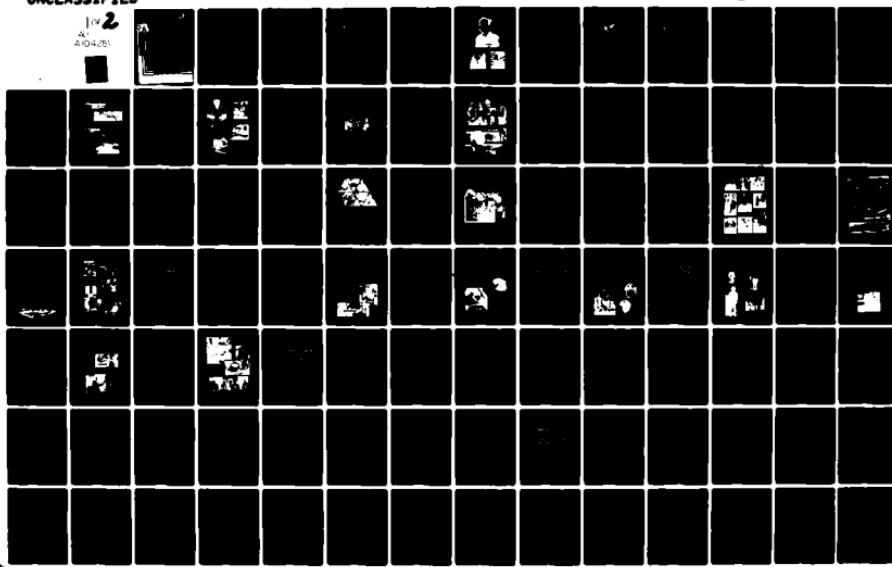
ARMY AEROMEDICAL RESEARCH LAB FORT RUCKER AL  
ANNUAL PROGRESS REPORT, FY 1980, 1 OCTOBER 1979 - 30 SEPTEMBER --ETC(U)  
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**US ARMY AEROMEDICAL RESEARCH LABORATORY**  
**ANNUAL PROGRESS REPORT, FY 1980**  
**(1 OCTOBER 1979 - 30 SEPTEMBER 1980)**

Reported By:

**Stanley C. Knapp, Colonel, MC**  
Commander

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October 1980

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**U.S. ARMY AEROMEDICAL RESEARCH LABORATORY**  
**FORT RUCKER, ALABAMA 36362**

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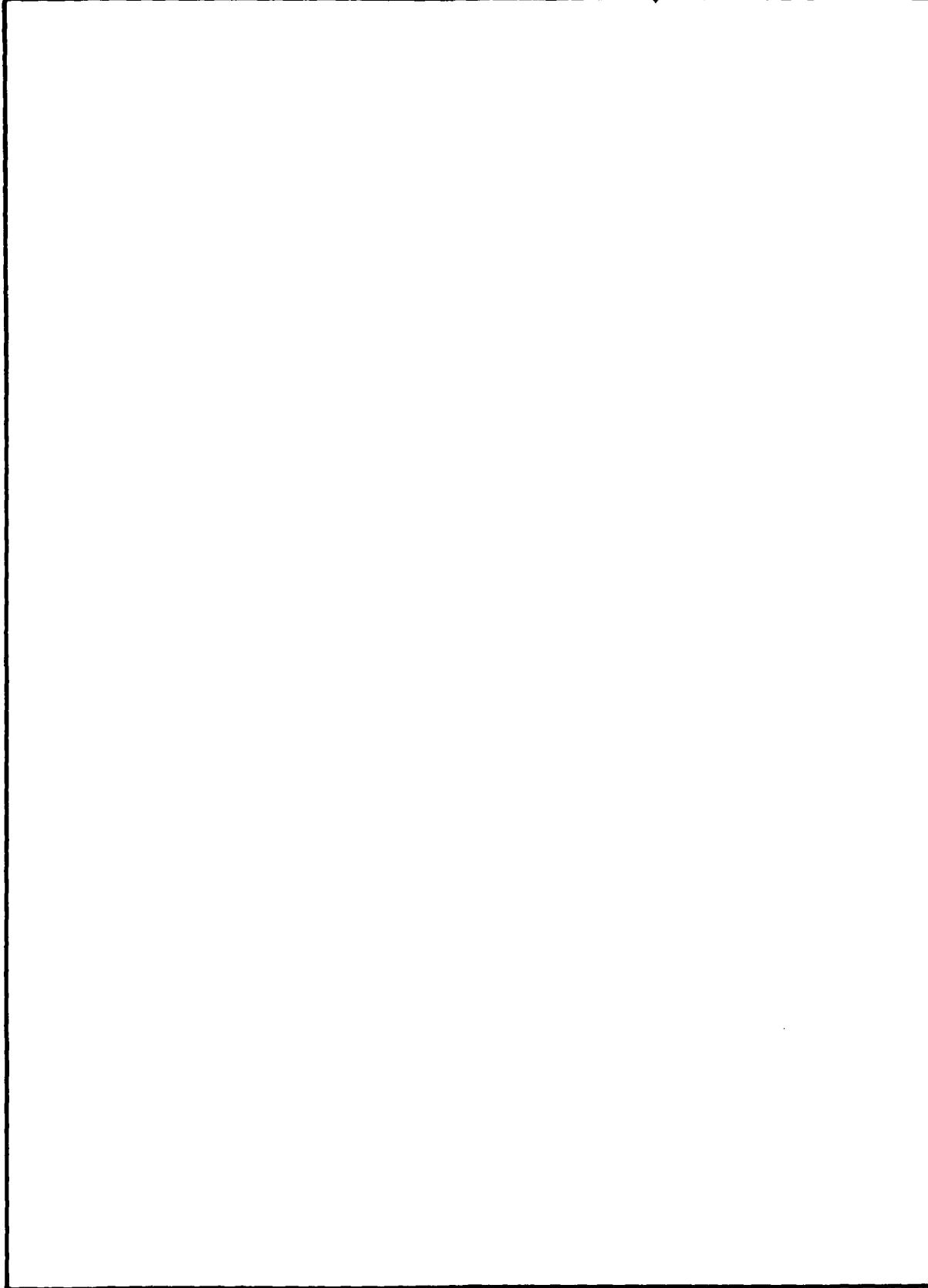
**USAARL**

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The annual progress report gives the FY 80 personnel and funding strength of the US Army Aeromedical Research Laboratory. It outlines the seven scientific programs being pursued by the laboratory. Those programs are: acoustics; biomedical aspects of vibration; visual physiology and psychophysics; sustained aviation operations, crew workload, and stress; impact physiology in support of crashworthiness and personal armor development; health hazard assessment; and medical aspects of crew selection. The DD Forms 1498 under which this work was authorized are in the Appendix.		

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# Mission Statement

Participates in the preservation and enhancement of the health, safety, combat effectiveness, and survivability of the soldier. Conducts life sciences research, development, test, and evaluation in health hazard prevention technologies and aviation medicine concerning human tolerance, survivability, and combat crew effectiveness related to combat vehicles, weapons systems, and operations. Develops, maintains, and applies minimum bases and technologies needed to establish human tolerance and exposure relationships for fire, noise, vibration, impact, and optical hazards, and, complementing other USAMRDC elements, physiological and psychological stressors. Develops and validates technologies for assessment of and protection from these health hazards.

Validates those relationships in order to recommend exposure and health effects criteria. Assembles and maintains the psychophysiological data base required to define operational envelopes for crew safety and effectiveness for Army aviation, combat vehicles, and parachuting. Develops health criteria for associated protective and life support systems. Conducts an active information transfer to health policy, combat and materiel developers, test and evaluation agencies, human factors agencies, and the aviation medicine community.

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COL STANLEY C. KNAPP, COMMANDER



LTC Roger P. Hula, Executive Officer



LTC David D. Glick, Deputy Commander

# Introduction

The U.S. Army Aeromedical Research Laboratory (USAARL) is a Class II medical research laboratory of the U.S. Army Medical Research and Development Command (USAMRDC), Office of The Surgeon General. USAARL is a tenant organization at the United States Army Aviation Center, Fort Rucker, Alabama.

The USAARL was established in 1962 to accomplish research in support of the Army aviation community and airborne activities and to provide a central aeromedical research and reference library for the Army aviation effort. Additional mission areas were added to the laboratory in 1974. The laboratory's further expanded mission now includes the assessment of the medical impact of advanced armor and artillery weapons systems and other nonmedical materiel.

Being located at the U.S. Army Aviation Center enables laboratory personnel to follow closely Army aviation developments. The location of other aviation research and development activities at Fort Rucker promotes a team approach to the solution of Army aviation problems.

USAARL's close liaison with aviation research laboratories of the Army, of other U.S. Armed Forces, government agencies and the civilian community enhances our research efforts.

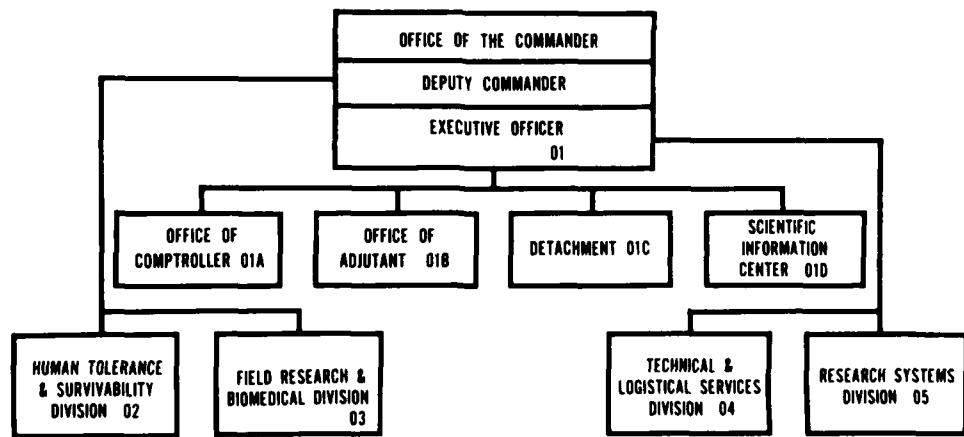
USAARL also maintains close coordination with foreign governments of NATO countries on aviation medicine matters through its involvement with the Advisory Group for Aerospace Research and Development (AGARD), a NATO organization.

This report gives an overview of USAARL during FY 80, identifies current areas of research and gives a brief description of the research programs. The DA Forms 1498 under which this research work is done are in the Appendix.

This report is prepared to fulfill the requirements of OTSG Regulation 70-31.



UNITED STATES ARMY AEROMEDICAL RESEARCH LABORATORY  
ORGANIZATIONAL CHART



# Management

The U.S. Army Aeromedical Research Laboratory's general research objectives remain the enhancement of individual and combat crew performance and efficiency and prevention of injury or death in the military operational environment.

USAARL continues to address these research objectives through identification, investigation and solving of medical and health related problems.

The personnel and equipment resources required to expand our capability for basic research in the psychophysiology of visual, noise/vibration and impact hazards are now established. These personnel and equipment resources should enable us to meet stated USAMRDC expectations and scientific requirements in the 6.1 program area.

The USAARL scientific programs are streamlined, efficient, and visibly on line with DA, AMEDD, and USAMRDC priorities. Scientific risk is low, but the pay off in reduced occupational morbidity and mortality and increased soldier efficiency has been great.

USAARL's research and contributions are recognized internationally by the operational and aeromedical communities. The men and women at USAARL take pride that their work is predicated on the needs of the soldier, and that the answers and solutions provided are relevant and timely to the operational needs of soldiers.

The challenges of FY 80 caused the laboratory management to take a hard and critical look at all phases of operation. The primary management objective was to maximize research within the limits of increasingly restrained personnel and fiscal resources.

The manpower survey of FY 78 had identified a need for additional scientific and engineering positions. These positions remained vacant through FY '79 but were filled in FY 80. Filling authorized scientific and engineering positions has increased our scientific capability. The personnel and equipment resources required to expand our basic research in the physiology of visual, noise/vibration, and impact hazards are now available.

USAARL had a productive \$688,000 extra-mural contract program and expanded from 10 to 17 contracts. The benefits of the contract program have been greatly enhanced through the mutual exchange of information and ideas between USAARL research personnel and academic research personnel performing as contract investigators.

Customer-funded projects played an important role in our FY 80 program. These projects enabled us to increase our in-house scientific data bases while at the same time providing direct scientific input to designers and developers of advanced military equipment. We've been able to "participate in the preservation and enhancement of the health, safety, combat effectiveness, and survivability of the soldier" by participating in the development of a product often during the concept formulation phase. We believe this "biomedical design criteria" information is of immense value to the ultimate user of the product.

Twin menaces of inflation and restrained resources, both financial and personnel, impacted USAARL during the year. The problems were not unique to USAARL, nor were the challenges presented by these menaces ignored. Programs were evaluated and often pared to "bare bones" essentials. In-house priorities were established to meet immediate and often changing circumstances. We have gained productive momentum in spite of these conditions.

We are looking to FY 81 with both anticipation and trepidation. An increased complement of scientific personnel and our new laboratory facility exemplify a bright, exciting tomorrow. On the other hand, restrained resources--scientific and support personnel and financial--remain a cause of grave concern.

The organizational structure of USAARL is shown in the accompanying chart. Two research divisions are supported by two service divisions and the headquarters group. These support personnel of the laboratory make an outstanding contribution. A brief report on their contributions will be shown under the management portion of this report.

The two research divisions' scientific effort is shown under Scientific Programs and Technical Participation sections of this report.

# **Support Divisions**

## **Headquarters**

The headquarters group, in addition to the Commander, Deputy Commander and Executive Officer, consists of Detachment Commander/Adjutant's Office, Comptroller's Office, and the Scientific Information Center.

### **Office of Detachment Commander/Adjutant**

The office of the Detachment Commander/Adjutant provides command and control functions for all enlisted servicemembers assigned to USAARL. All military personnel actions (officer and enlisted), enlisted disciplinary actions, and mandatory subject training were performed by this office.

This office coordinated all USAARL's administrative functions, provided postal support, protocol services, and aviation and laboratory safety support.

Technical editing and writing support, public and command information programs, and exhibit coordination were provided through the Writer-Editor's office.

USAARL's enlisted personnel have for years been housed in renovated WW II barracks. During FY 80 enlisted personnel were moved to a new, dedicated wing of an enlisted housing facility belonging to the U.S. Army Aeromedical Center.

## **Office of the Comptroller**

The Comptroller Office, consisting of one supervisory program analyst, one management assistant and two budget clerks, is responsible for program/budget, fiscal, manpower/personnel activities, as well as management analysis, and centralized statistical data reporting for USAARL. In addition, this office has technical supervision of two budget clerks assigned to each research division.

FY 80 saw some unexpected turbulence within the office with the retirement of the supervisory program analyst, the increased workload caused by the still unfilled management assistant position, and the loss of one division budget clerk. One FY 81 objective will be to obtain a budget analyst to assist in program/budget and fiscal activities and provide continuity of operations should the supervisory position again become vacant.

The Comptroller Office strives to incorporate data processing capabilities in records maintenance where feasible. One example is the RDTE requirement to maintain formal commitment records.

Formal commitment records are maintained by use of USAARL's in house computer program. Access terminals are available in all organizational elements. All fiscal data is entered to allow access by each project manager, branch chief, division director, the commander or his immediate staff on a daily basis. Data can be retrieved at project level or laboratory total as cumulative data by element of expense, net available balance, man-hours expended and fixed cost remaining. Each manager can obtain a listing of all items for which funds have been committed by requisition number, nomenclature, dollar value and date ordered. If data is required for only one element of expense such as equipment, TDY, contract services or payroll, a listing or printed copy is immediately available.

Data is entered by budget clerks in the Comptroller Office when funds are certified. Adjustments are made immediately as price increases, decreases or cancellations occur.

## **Scientific Information Center**

The library, now designated the Scientific Information Center, was tasked in the original mission to "provide a central aeromedical research and reference library for the Army aviation effort." The Scientific Information Center provides these services and has expanded to include integrating the information center concept into USAARL operations. Plans have been made to broaden collection capabilities through adding on-line data base system of the Defense Technical Information Center (DTIC) and Dialog.

Request for library material doubled (1200 to 2400) in FY 80. The Scientific Information Center added 2000 items to the collection bringing the total collection to 42,000 items. Library instruction/orientation classes were held for 21 cooperative education students and four classes of flight surgeons.

The Scientific Information Center provided resource support to Southeast Alabama Medical Center, Dothan, Alabama, on an "as can" basis.

Two library publications were completed in July 1980, *Union List of Periodicals in Libraries at Fort Rucker*, and *Journal Citations*.

## **Research Systems Division**

The Research System Division supplies all computer services, data systems and instrumentation services, mathematical and statistical consultations, and aviation support for the laboratory.

The helicopter in-flight monitoring system (HIMS I) was repaired and refurbished and the HIMS II, to replace HIMS I, was designed and fabricated for use in the JUH-1H. These projects required electronic, computer and aviation support.

RSD's series of in-house training seminars upgraded the technical skills of the electronic technicians and the engineering co-op students, thereby providing USAARL with improved technical capabilities.

A major task in FY 80 was the implementation of Phase 1 of USAARL's Work Measurement Program, a computerized management tool for task and time accounting. Research System Division's task data were computerized as were Human Tolerance and Survivability Division's clerical personnel task data.

## **Aviation Support**

Research into the medical problems arising from the unique aviation occupation requires the laboratory to go to the flying soldier--pilot or crewmember.

Simulation is a valuable tool but often it is not the answer. Therefore, USAARL goes to the aviator by performing research in the aviator's workday environment, the aircraft.

Aircraft are important tools supporting USAARL's research efforts. We have four aircraft: JU-21G, JUH-1H, JOH-58, and JUH-1M. All four carry the "J" that designates they have been modified for research use.



Being located at the Army Aviation Center one would assume an excess of aviation support, but to collect needed data requires aircraft modifications not found on training or combat aircraft. These modifications make it possible for us to study advanced systems and concepts and how they effect the pilot or crewmember.

The JUH-1M is a helicopter modified with an Iroquois Night Fighter and Night Tracker System (INFANT). The INFANT is a low light level TV system which has been modified by USAARL to support the laboratory's electro-optical work on the Integrated Helmet and Display Sight System (IHADSS) to be used in the Advanced Attack Helicopter. Only at USAARL is there the capability of assessing visual capability with the IHADSS in real operational scenarios at the High Falls, USAARL's instrumented test range.

The JU-21G is a Beech King Air modified and specially equipped for sustained high altitude research on advanced and emerging oxygen generating systems. The oxygen generating systems have met all preliminary requirements through altitude chamber testing at the U.S. Army Aeromedical Center.

During FY 80 modifications on the JUH-1H made it possible to examine three different generic navigation systems for their effect on copilot/navigator workload and performance during nap-of-the-earth (NOE) flight. Similar studies comparing the navigation performance with the three systems have been performed but no one has examined the effects on workload that these systems may have.

The use of the helicopter inflight monitoring system (HIMS)--installed as a major modification on the aircraft--enabled us to study the effects upon Army aviators of continued flight with night vision goggles (NVG). In order to simulate combat conditions pilots may encounter if required to fly all night, pilots flew continuously 6 hours while wearing the NVG. This type data collection would not have been possible without the organizational aircraft. Safety measures dictate that a cover aircraft (JOH-58) be available to provide assistance during flight research projects. In a 2 month period, we flew 10 pilots for a total of 336 flight hours.

Seven MSC research aviators are assigned to USAARL. As a result of emphasis on flight standardization and effective flight training, all USAARL flight hours since 1963 have been accident free.

Flight hours in FY 80 were:

Research hours	780.3
Training hours	295.7
*Other hours	85.8
	<hr/> 1161.8

\*Test flight, USAAVNC use, maintenance ferry flights, etc.



## **Technical and Logistical Services Division**

Technical and Logistical Services Division breaks their support activities into five sections--scientific arts, laboratory crafts biomedical maintenance, supply, and property book.

Work orders and supply requests are submitted to T&LS by the division or person requesting their support service. The FY 80 break out of requested services and supplies was:

Scientific Arts	560	Works Orders
Laboratory Crafts	178	" "
Bio-medical Maintenance	1665	" "
Supply	2180	Orders
Property book	2197	Orders received
" "	678	Items turned in

The T&LS Division continued to monitor construction of the new laboratory building, to work on furniture and equipment needs for the new laboratory and to plan and implement procedures for minor construction of the small animal facility.



**PROGRAM FUNDING FY 78-79-80  
(Thousands of Dollars)**

FY YEAR	6.1 RESEARCH	6.2 DEVELOPMENT	6.5 MANAGEMENT SUPPORT	REIMBURSABLE	TOTAL
78	521.7	2434.5		451.9	3408.1
79	725.0	1984.0	450.0	662.1	3821.1
80	421.1	2120.2	110.8	467.8	3119.9

NOTE: FY 79 funds used in FY 80--\$474.4

# Funding

## Customer-Funded Projects

Customer-funded projects are a complementary effort to our established scientific research program. However, customer-funded projects have increased the capability of our core program. The additional funding has allowed us to increase the level of ongoing work, to acquire equipment and supplies, and to supplement core funds that could not be supplied by Medical Research and Development Command. The customer-funded projects gave us flexibility in terms of civilian pay and funding.

Customer-funded projects foster a sharing situation. The designers and developers buy our expertise in areas where they normally do not have the scientific manpower to accomplish a specific scientific task; for example, vision related area. We perform the research, accumulate the data, and provide them a real product in terms of data and letter reports. We increase our scientific data base as we supply the information sought by the designers and developers.

There were four FY 80 customer-funded projects for a total of \$467,800. The projects, funding agency, and a brief progress report are given.

**Title** Aviator Workload/Performance Assessment in Support of Support of Advanced Attack Helicopter (AAH)

**FUNDED BY:** AAH-64 Project Manager, Aviation Research and Development Command (AVRADCOM)

**INVESTIGATOR:** C. E. Rash; LT D. Cote

**Objective** To investigate the physiological and psychological limits of human capability and compatibility with aviator crew stations, crew tasking and consequent cumulative crew workload, stress and fatigue in the YAH-64 and provide data which will



point out areas of system design hampering mission effectiveness. To organize and assess aviator performance data with which to determine the navigation performance and procedures for AAI crewmembers.

**Progress** Projected map display was obtained and installed in the JUH-1H instrumented research helicopter with a Doppler navigation system. Several test flights were made with the navigation equipment and data collection equipment to insure proper functioning with adjustment/repairs having been performed as required. Over one-half the data have been collected with data reduction and analysis being performed between research flights.

**Title** Health Hazard Assessment and Implications of Whole-Body Vibration Associated with Advanced Combat Vehicle Technology

FUNDED BY: Tank and Automotive Command (TACOM)

INVESTIGATOR: J. C. Johnson; Isaac Behar

**Objective** A multidisciplinary approach will be used to assess the effect of whole-body, low-frequency vibration and noise peculiar to advanced combat vehicles on human visual, vestibular, hearing, and musculoskeletal systems. Dynamic characteristics of the High Survivability Test Vehicle-Light (HSTV-L) semisupine seat will be determined by Fourier transform techniques using instrumented human subjects on the USAARL multiaxis vibration table. Stress and fatigue reactions including neck muscle stress and head coupled vibration will be assessed by standard biochemical and psychophysiology as well as specialized electromyographic techniques. Dynamic visual acuity and eye fatigue will be studied under multiple conditions of target display, head and eye movement, and frequency phase controlled vibration, contrast, and luminance. These effects will be correlated in relation to their relative hazards to acute or chronic injury potential and influence on crew performance, comfort, and efficiency.

**Progress** Instrumentation has been acquired, installed, and calibrated for determining human response to vibration. The vibration data acquisition system provides information that is used to validate or expand the scope of human vibration models developed for other seating arrangements. A computer driven imaging system for measurement of dynamic visual acuity (DVA) using a video display is scheduled for delivery on 15 Sep 80 and data collection will follow. The DVA system was designed to have stand-alone capability. A two-channel audiometer is now on hand to monitor vibration induced hearing threshold effects which may appear.

The first in a series of experiments using human volunteers was completed. The experiment demonstrated that significant (+500%) increase in neck muscle stress occurred in the full supine seat position when the volunteer lifted his head to isolate it from the vibration of the headrest. Lesser increases in neck muscle stress occurred as the seat back angle approached vertical. The volunteer's head vibration was greatly reduced at frequencies above 20 Hz where he lifted his head off the headrest. At lower frequencies the head vibration was only moderately reduced by lifting the head.

**Title** Development of Measurement Techniques for the Medical Assessment of Visually Coupled Systems (VCS) Components

FUNDED BY: AAH-64 Project Manager, Aviation Research and Development Command (AVRADCOM)

INVESTIGATOR: C. E. Rash

**Objective** It is possible to compromise an aviator's safety, physiological performance and his ability to fly when designing and fabricating a visually coupled system (VCS). The VCS hardware must be scrutinized carefully to insure mutual man-machine conformity. The first phase of this study was concerned with the Helmet Mounted Sight (HMS) component of the VCS. The laboratory experiment was conducted to determine aiming and tracking capabilities of aviators using head orientation coupled trackers. The effects of eye dominance, helmet suspension, helmet weighting and target speed on accuracy were investigated. The second phase focuses on the assessment of helmet mounted displays (HMD). Factors such as display color, image quality and size, brightness, contrast and their impact on the visual system of the crewmember and consequent performance will be investigated. From these investigations measurement techniques for the assessment of visually coupled systems will be developed.

**Progress** The phase II airborne validation of the phase I aiming/tracking data and quantitative medical assessment of a crewmembers's pilotage and navigation performance using a VCS were completed. The head tracking data of the study has been analyzed and the report is now being written for publication. A hardware/software package for creating a data base to evaluate the contrast between symbology and various backgrounds has been written. The data base will contain spectral characteristics of the different backgrounds, phosphors, visors, combiners, blastshield, and windscreen. Upon completion of the data base and a modeling program, the VCS will be evaluated as a whole.

**Title** Combat Vehicle Crewman (CVC) Helmet-Impact and Acoustical Evaluation

FUNDED BY: US Army Natick Research and Development Command (NARADCOM)

INVESTIGATOR: R. Camp; T. Hundley

**Objective** The objective is to develop a combat vehicle crewman (CVC) helmet which provides acoustic and impact protection and high quality voice communication without hearing damage.

The approach is to: (1) measure impulse noise of combat vehicles, (2) establish sound attenuation requirements for adequate protection in CVC environment, (3) establish electro-acoustic characteristics for equipment to assure compliance with hearing conservation requirements, (4) investigate ear seal configuration for maximum sound attenuation, (5) evaluate impact hazards in combat vehicles and specify design criteria, (6) determine need and design of a suspension and retention system and, (7) determine qualification test procedures.

**Progress** Collection of impulse noise data has occurred with the 105mm cannon with the 50 caliber machine gun in the M60-M60A tanks. Similar data collection on the 81mm and the 4.2in. mortar has occurred in the M113 armored personnel carrier. These data are currently being analyzed to establish a design requirement for sound attenuation for impulse noise. Simultaneously, real-ear attenuation characteristics and electro-acoustic characteristics have been obtained on existing and proposed hearing protectors to include the DH 140, DH 178, 9 AN/7, and the Gentex P/N 4917-2. The PASGT helmet was utilized as indicated to assess the combined effect of the hearing protector and the helmet. USAARL LR 80-9-2-3 pertains to the DH 140 and a second report involving the balance of the alternate results is in progress.

## Contracts

The comprehensive extra mural contract program, begun in FY 79, has continued to expand and has proved a valuable and productive asset in FY 80. Contracts carried forward from FY 79 report give a statement of progress in addition to the objective. Some contracts were funded and begun late in FY 80 and have only the objective shown.

**Title** Spatial-Temporal Resolution of Local and Extended Stimuli in the Human Visual System

CONTRACT NO: DAMD17-71-C-7007, Accession No. 7888  
CONTRACTOR: Texas Tech  
Lubbock, Texas

INVESTIGATOR: Perry Speros

**Objective** The objective is to determine the visual capability of aircrew at different times during recovery from image intensifier adaptation.

**Progress** Investigators measured the classical dark adaptation curves following preadaptation to different durations of the conditions simulating the AN/PVS-5 optical image intensifier. During the second stage, the experimental design for the presentation of sine-wave grating was developed. Electronically generated sine-wave gratings on a high resolution video monitor CRT were the most efficient and versatile method for presenting test targets.

The recovery time to detect sine-wave gratings at five different contrast levels ranging from 10% to 75% contrast was measured at three average target luminance levels corresponding to three night viewing conditions. Five young adult subjects were used. The recovery time was measured after the subject was preadapted to three simulated optical image intensifier luminance levels.

The average recovery time over five subjects was linearly proportional to the log contrast for all frequencies and luminance levels used.

Additional work included in the extension of this contract is reported on page 29.

**Title** Night Vision Performance in Detection and Identification of Moving Targets After Glare

CONTRACT NO: DAMD17-71-C-7055, Accession No. DAOD 7887  
CONTRACTOR: Optical Sciences Group, Inc, Visual Science Division, 24 Tiburon Street, San Rafael, California

INVESTIGATOR: A. J. Adams

**Objective** This research is needed to identify vision environments which can be expected to maximize or minimize personnel performance at night in continuous military operations. It is vital to know the degree of impairment of detection produced in aircraft and equipment operators exposed to environmentally relevant levels of photostress.

**Progress** Contrast thresholds for detection and resolution were determined at scotopic light levels for static and moving targets of different sizes. The sensitivity for detection is highest

for moving targets while the sensitivity for resolution is highest for static targets.

Glare recovery measurements for detection and resolution were also performed at scotopic background levels for the same target parameters used in the thresholds measures without glare. Glare recovery is linearly related to target contrast for both resolution and detection over the range of contrasts used. The results indicate that performance on the glare recovery task cannot be predicted on the basis of contrast threshold alone. The results also show that one can predict glare recovery for either detection or resolution of different size targets moving at different velocities on the basis of a single glare recovery measurement for a specific size and velocity using either detection or resolution as the criterion.

Contract is completed and a report will be submitted.

**Title** Auditory and Non-auditory Effects of Exposure to Low Frequency Noise

CONTRACT NO: DAMD17-79-C-9180, Accession No. DAOG 1825  
CONTRACTOR: Department of Otolaryngology, Medical University of South Carolina, 171 Ashley Ave., Charleston, South Carolina

INVESTIGATOR: John H. Mills

**Objective** The determination of the extent and frequency region of auditory temporary threshold shifts in humans from exposure to low-frequency noise as well as an indication of the role, if any, of exposure to low-frequency noise to act as a stressor which will be reflected by elevated cortisol, epinephrine, norepinephrine, and blood pressure levels.

**Progress** Due to delays in equipment acquisition, data collection was delayed. Data collection is now in progress and approximately 80% complete. A request for extension without funding has been approved.

**Title** Research and Development of Cochlear Microphonic Response to Low Frequency Noise

CONTRACT NO: DAMD17-78-C-8067, Accession No. DAOC 7886  
CONTRACTOR: University of Florida, Gainesville, Florida

INVESTIGATOR: Donald Teas

**Objective** Many military vehicles, particularly those found in armor, produce high intensity noise which is predominately low frequency. The objective of this study is to explore the mechanism of noise induced hearing loss exposure to high intensity, low frequency noise.

**Progress** Progress on this contract is reflected in the presentation of two papers to the Acoustical Society of America, Spring 1980, entitled (1) Acoustic properties of the external auditory canal in chinchilla, guinea pig, cat, and man and (2) Spectrum of the CM produced by high intensity low-frequency noise bands in the chinchilla. Transfer functions of the External Auditory Meatus (EAM) have been determined for chinchillas. Cochlear microphonics (CM) have been determined in Turn II for wide band noise, 100 low pass noise, 250 Hz low pass noise. Components in the CM at frequencies above the low pass noise cut off have been detected with high level stimulation. However, the direct bearing of CM spectral analysis upon exposure to high intensity, low frequency noise is not as direct as anticipated.

**Title** Effects of Visibility

CONTRACT NO: DABT01-79-C-0512-1  
CONTRACTOR: Institute of Medical Sciences, Smith-Kettlewell Institute of Visual Sciences, 2200 Webster St., San Francisco, California  
  
INVESTIGATOR: Anthony J. Adams  
Gunilla Haegerstrom-Portnoy

**Objective** Investigate spatial, temporal and retinal eccentricity effects on visibility in the dark-adapted eye.

**Progress** Progress has been made which complements work on the effects of various spatio-temporal configurations of adapting lights upon subsequent sensitivity by determining: 1) the influence of the spatio-temporal distribution of test lights upon dark adapted detection thresholds and 2) detection vs. resolution thresholds under various states of adaptation.

**Title** Simula II

CONTRACT NO: DABT01-79-C-2050-1  
CONTRACTOR: Simula Inc., 2223 S. 48th Street, Tempe, Arizona  
  
INVESTIGATOR: Stanley P. Desjardins

**Objective** Phase II in the requirement to develop crashworthy earcups for the SPH-4 Army aircrewman helmet.

**Progress** Development of prototype tooling has been delayed. No-cost extension into FY81/1 was requested.

**Title** Material Characteristics

CONTRACT NO: DABT01-79-C-0045-1  
CONTRACTOR: Auburn University, Auburn, Alabama

INVESTIGATOR: Warton Jemian

**Objective** Research into the optimum characteristics of materials for head protection during impact.

**Progress** Draft report received from Auburn University. Contract to be completed in Oct 1980.

**Title** Multiaxis Impact Experiment on Volunteers

CONTRACT NO: ARL-MIPR-2-79 (DD 448)  
CONTRACTOR: USN Aerospace Medical Research Laboratory  
(Mischedou Station), Pensacola, Florida

INVESTIGATOR: Channing Ewing

**Objective** This Tri-Service project was undertaken to measure kinematic response of critical anatomical parts of volunteers undergoing impact.

**Progress** The sled support fixture design was completed as a result of FY 79 funding. Project funding unavailable in FY 80.

**Title** Mechanisms of Human Injury

CONTRACT NO: ARL-11-79 (DA 2544)  
CONTRACTOR: Applied Technology Laboratory, USA Research  
and Technology Laboratory, Ft. Eustis,  
Virginia

INVESTIGATOR: Albert King; George Singley, III

**Objective** This work is done to support the Tri-Service human tolerance investigation. The objective is to determine the mechanisms of human injury when deceleration occurs in a crash-worthy crew seat. This subcontract is part of a Tri-Service supported contract, Human Body Ejection Seat Dynamics, being conducted at Wayne State University School of Medicine. Executive agent for the Wayne State study is the USAF Aerospace Medical Laboratory, Wright Patterson AFB, Ohio.

**Progress** Seven human surrogate impacts have been completed; two more impacts are funded. Project continuation in FY 81 is anticipated.

**Title** Evaluation of Inner Ears (Chinchillas) for Loss of Sensory Cells Using a Surface Preparation Histology Technique

CONTRACT NO: DAMD17-78-C-8009, Accession No. DAOD 7888  
CONTRACTOR: Syracuse University, Syracuse, New York

INVESTIGATOR: Roger P. Hamernik

**Objective** To determine extent of damage to the cochlea from noise exposure. (NOTE: Reported in FY 79 under "Inner Ear Histology." Title changed to more accurately reflect the work to be done.)

**Progress** Chinchilla cochlea from animals exposed to continuous noise bands from 31 Hz to 250 Hz have been examined. No strong correspondence between damage and audiometric hearing loss has been noted. Chinchilla cochlea from animals exposed to impulse noise have shown extensive loss of outer hair cells. This contract has been terminated due to departure of investigator. Another contract has been awarded to the University of Texas, Dallas, Richardson, Texas for completion of this work.

**Title** Evaluation of Inner Ears for Loss of Sensory Cells

CONTRACT NO: DAMD-17-80-C-0109  
CONTRACTOR: Callier Center for Communication Disorders,  
University of Texas, Dallas, Richardson,  
Texas 75080

INVESTIGATOR: Roger P. Hamernik

**Objective** To determine extent of damage to the cochlea from noise exposure.

**Progress** None. (New start. Contract transferred from University of Syracuse.)

**Title** Effects of Hearing Protectors on Human Auditory Localization

CONTRACT NO: DAMD17-80-C-0131, Accession No. DAOG 3438  
CONTRACTOR: Florida State University, Tallahassee,  
Florida

INVESTIGATOR: L. F. Elfner

**Objective** Current military weapons such as the M198 VIPER and the M109 produce blast overpressures which require combinations of hearing protectors. The contract will develop methods to determine the effects of these protectors on the ability of the soldiers to localize sounds. The localization of sound is considered essential to safety and operational effectiveness.

Results of this study will have direct implications for improved protector design and provide a methodology to be used throughout development of future hearing protective devices for use around Army weapons.

**Progress** (New start as of Aug 80. No progress report.)

**Title** Blast Trauma: The Effects on Hearing

CONTRACT NO: DAMD17-80-C-0133, Accession No. DAOG 5020  
CONTRACTOR: Callier Center for Communication Disorders,  
University of Texas, University of Texas,  
Dallas, Richardson, Texas 75080

INVESTIGATOR: Roger P. Hamernik

**Objective** The objective of this study is to extend our basic knowledge of the nature of injury to the hearing receptors resulting from exposure to impulsive sounds (blast overpressure). Army weapons systems produce impulse noise which may be hazardous to hearing. Our current data base from which to assess the hazard is inadequate. The results of this study will contribute to that data base by providing new information about the nature of the injury.

**Progress** None. (Funded late in fiscal year.)

**Title** Spatial-Temporal Resolution of Local and Extended Stimuli in the Human Visual System

CONTRACT NO: DAMD17-77-7007,  
CONTRACTOR: Texas Tech University School of Medicine,  
Lubbock, Texas

INVESTIGATOR: Perry Speros

**Objective** This research project is aimed at identifying psychophysically the sensitivity and spatial characteristics of sustained and transient neural mechanisms under different stimulus conditions. This work shall add to a continually growing data base concerned with static and dynamic visual capabilities.

**Progress** Equipment for the project is on order. An electronic system for generating complex visual stimuli has been designed and is being built.

**Title** Study for Vibration Effects on Muscular Performance

CONTRACT NO: DAMD17-80-C-0054, Accession No. DAOG 2591  
CONTRACTOR: University of Miami, Department of Industrial Engineering, Coral Gables, Florida

INVESTIGATOR: Carl Greco

**Objective** This research is required to determine the effect of indirect vibration on fine muscular control, the frequencies and magnitude of vibration most detrimental to fine muscular control and the correlation between fatigue induced changes in electromyographic data and fatigue induced decrement in fine muscle performance during tracking.

**Progress** The university has ordered all necessary equipment. The university has assembled the equipment into a system for measuring muscular response to vibration stimulus. The investigators are currently developing appropriate recording instrumentation and performing initial trials with volunteer subjects to validate the instrumentation. Contract effort will continue through May 1981.

**Title** Effect of U.S. Army Headgear on Neck Muscle Loading and Fatigue

CONTRACT NO: DAMD17-80-C-0089

CONTRACTOR: Wright State University, Department of Biomedical Engineering, Dayton, Ohio

INVESTIGATOR: Chandler A. Phillips

**Objective** Pure isometric exercise is commonly used during postural adjustments such as the neck muscles holding the head (and helmet) erect during (1) flying (and tracking) activity, and (2) driving (and tracking) activity in armored vehicles. Since helmet design influences the onset and recovery from isometric cervical (neck) muscle fatigue, the need exists to objectively quantitate both load on the neck as well as fatigue "end-point." The purpose of this experiment is to compare how different helmet designs (PASGT-Infantry, PASGT-Airborne, CVC and SPH-4) load the cervical muscles and affect fatigue and end-point. The maximal voluntary contraction (MVC) of two different cervical muscles (trapezius and sternocleidomastoid) will be measured under isometric conditions. Experiments will then be performed to set the length of time that prescribed contraction patterns (lateral rotation, dorsiflexion, and both alternately) must be performed to predict accurately the endurance times and to set accurately the endurance times and to set accurately the rest interval between the contraction patterns so that the muscle is not fatigued during a second (and subsequent brief) contraction pattern in each series for each helmet type. Adequate safeguards will be followed to minimize "training effect" in untrained subjects. The final series of experiments will be conducted on trained military personnel at Fort Rucker, Alabama, and the data subsequently analyzed at Wright State University.

**Progress** Necessary equipment has been ordered by the university. The university has completed fabrication of an iso-kinetic dynamometer and is conducting phase 1 of the experiment which is training of the six research subjects. The university is currently negotiating terms of a subcontract to develop a variable weight and center of gravity helmet for use in this study. Contract efforts will continue through May 1981.

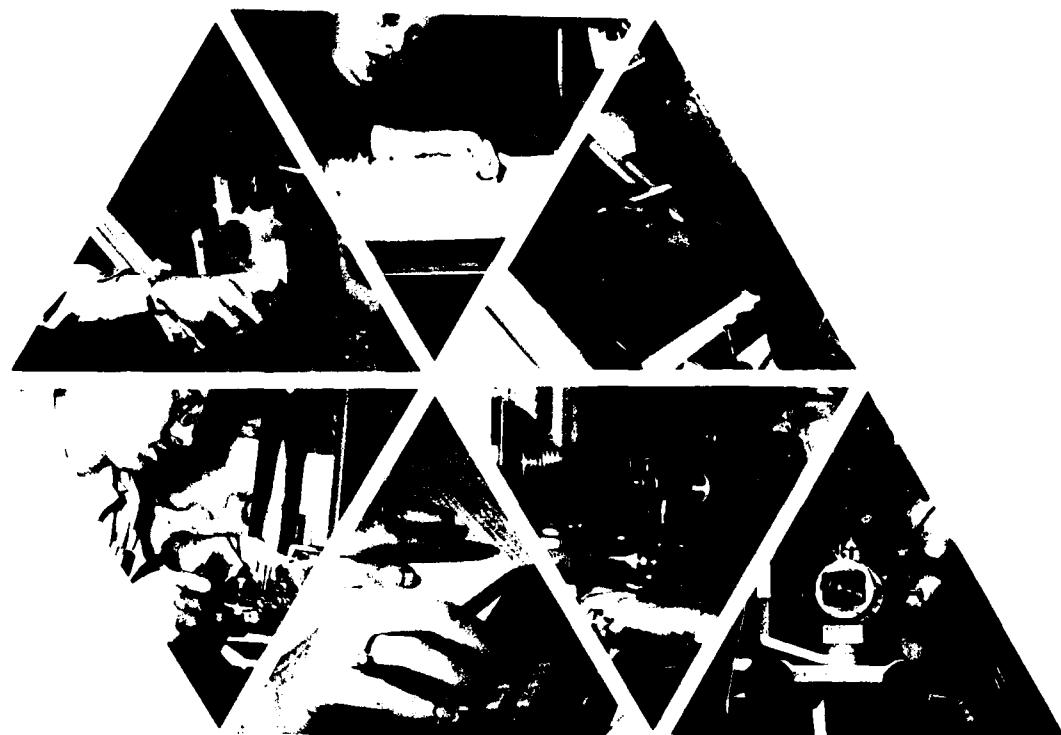
**Title** Helmet Display Optics Redesign for Improved Visual Compatibility

CONTRACT NO: DAMD17-80-C-0063  
CONTRACTOR: Honeywell, Inc., Minneapolis, Minn.

INVESTIGATOR: Dayton Walker

**Progress** To redesign Integrated Helmet and Display Sighting System Helmet Display Unit (HDSU) using all glass elements. The design shall be optimized for P43 phosphor spectral emission.

**Objective** Redesign has been completed and glass units pass all transmission, distortion, contrast transfer function and field-of-view tests.



#### PERSONNEL STRENGTH

FY 78	OFFICER	EM	CIVILIAN PERM/TEMP.	CO-OP STUDENT	TOTAL
AUTHORIZED	30	38	66 0	0	134
ACTUAL	29*	32**	55 5	1	129
<hr/>					
FY 79					
AUTHORIZED	31	46	65 1	0	142
ACTUAL	29*	40**	55 8	9	141
<hr/>					
FY 80					
AUTHORIZED	30	47	59 6	0	142
ACTUAL	24*	42**	***57 3	9	135

\*Includes one Navy officer.

\*\*Includes one Air Force sergeant.

\*\*\*Does not include three (3) commitments who came on board 6 Oct 80.

# **Personnel**

The laboratory's most valuable asset is its personnel. The professional, technical, and administrative personnel all possess a high level of skills and abilities. Among the laboratory's professional personnel, there are 14 doctorate, 17 master, and 25 bachelor degrees.

USAARL continues its support and upgrading of the skills of all laboratory personnel. Training is a vital element in maintaining and improving the job proficiency of assigned personnel. Personnel attended classes given by USAARL, by Fort Rucker Civilian Personnel Office, by equipment manufacturers, and by formal training institutions. By taking full advantage of all sources of training in FY 80, seventy-two people were able to receive training and professional development.

Professional conferences, seminars, and associated tutorials and short courses help scientists stay current in their specialty. They are an avenue for scientific information exchange of great importance to the research scientist. Twenty-seven people benefited from such training experiences this year.

Military personnel maintained proficiency and currency in their military specialties as well as their scientific field by attending military courses. Mandatory training requirements were met. In addition to receiving training, two servicemembers served as skills qualification training (SQT) instructors for all Fort Rucker personnel in their SQT area.

During FY 80, three persons reenlisted or extended their enlistment for a total of 10 years.

A Navy Officer and an Air Force NCO are on assignment to USAARL to work in areas considered vital to the Navy and Air Force but not being duplicated in their own laboratories.



## **Co-op Program**

USAARL's cooperative education program continued to grow in FY 80. Five more universities placed students at the laboratory, increasing to 13 the number of universities with students in our program. We continue to work with all 29 universities that have cooperative education agreements with Fort Rucker to recruit the best possible talent.

The USAARL Co-op Handbook was completed and distributed to incoming co-op students. The handbook is a concise guide to the co-op program and to student participation while at USAARL.

During FY 80, we had a total of 25 undergraduate and 7 post-graduate fellows contributing 11.13 man-years of time to the laboratory's research efforts. One undergraduate and two postgraduate students successfully completed their co-op assignment in FY 80.

An immediate and very tangible benefit the co-op program has brought to USAARL is the services of a much needed research librarian. As a co-op graduate student in library science, our new librarian worked and trained in USAARL's Scientific Information Center.

## **Mobilization Designee (MOBDES) Program**

The MOBDES program is designed to facilitate rapid expansion of the US Army Medical Research and Development Command by preassignment of selected US Army Reserve (USAR) officers. It is also designed to use the designee's scientific and administrative capabilities during peacetime or non-mobilization periods to benefit and enhance the USAMRDC missions. The USAARL MOBDES program, approved in FY 80, has fifteen designee positions. The USAARL program includes allied science officers, medical officers, aviators, and a unique set of combat arms officers.

These combat arms officers provide a dual enhancement to the USAARL mission in that they bring their combat arms experience and know-how to the medical research programs supporting health hazard assessment of materiel systems, such as prototype armored vehicles and developmental cannon artillery weapon. They also bring their civilian technical and professional skills to enhance or supplement the in-house capability of the lab. As an example, we have an armor officer designee who is also an architectural engineer. This

individual was able to participate in armor system related biomedical research and at the same time provide guidance and assistance on design and development of research facilities.

A meaningful MOBDES program is only as good as the training, challenges, and close relations provided by the supervisory personnel of the designees. While the designees participate in the lab during a two week active duty period each year, frequent contact between designee and supervisor exists well before the active duty training period. Supervisors disseminate information on projects and proposals of expected work to be accomplished, and on the status of the on-going facets of the designee's commitment to the research program.

## **Worker Trainee Program**

The worker-trainee program received great emphasis at Fort Rucker in FY80. USAARL has two worker-trainees in permanent clerical positions and employs "on loan" two additional worker-trainees.

The work-trainee program is designed to give unskilled persons an opportunity to develop their potential skills over three years. They enter the work force at the GS-1 level and through satisfactory on-the-job and classroom training improve their skills to meet the requirements of the next level.

Supervisors are actively involved on a daily basis in on-the-job training and in developing and implementing the formal training plan.

The worker-trainee program is a productive effort to further affirmative action goals.

## **Affirmative Action**

Cooperation between USAARL and Fort Rucker on measures to further affirmative action goals is evidenced by the continued growth of the co-op program, participation in the worker-trainee program, and the use of upward mobility positions.

USAARL's Federal Women's Program Manager (FWPM) acts as the laboratroy representative to the Fort Rucker FWP Committee.

## **O1H Program**

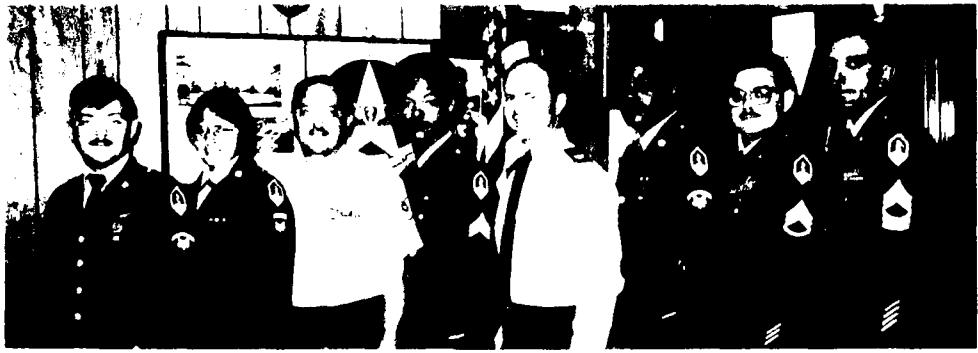
The recruitment effort to fill vacant slots under the Development Contract October 1979 (ISAF) had 120 O1H personnel authorized with only two filled.

There has been a concerted effort to obtain fielded personnel placement by the Commanders in chief source of eligible personnel of active duty soldiers.

A Military Personnel Program pamphlet prospect was published in October 1979. This pamphlet was distributed to all units in USARLC, Fort Sheridan, Illinois. A copy of this pamphlet was then sent to each unit in USAREC also sent out information concerning the O1H program to all recruiters of the O1H Mgrs.

Articles telling of the O1H program have been published in Soldier's Magazine, numerous post newspapers, and accepted for publication in Army Times.

The success of this program emphasis can be measured by the numbers. As of September 1980, of the 169 authorized O1H positions, USAMRDC had 143 filled and was expecting nine additional personnel. USAARL had all ten authorizations filled.



# **Personnel Achievements**

## **Civilian Awards**

	<b>No. Presented</b>
Outstanding Performance	31
Quality Step Increase	2
Sustained Superior Performance	4

## **Military Awards**

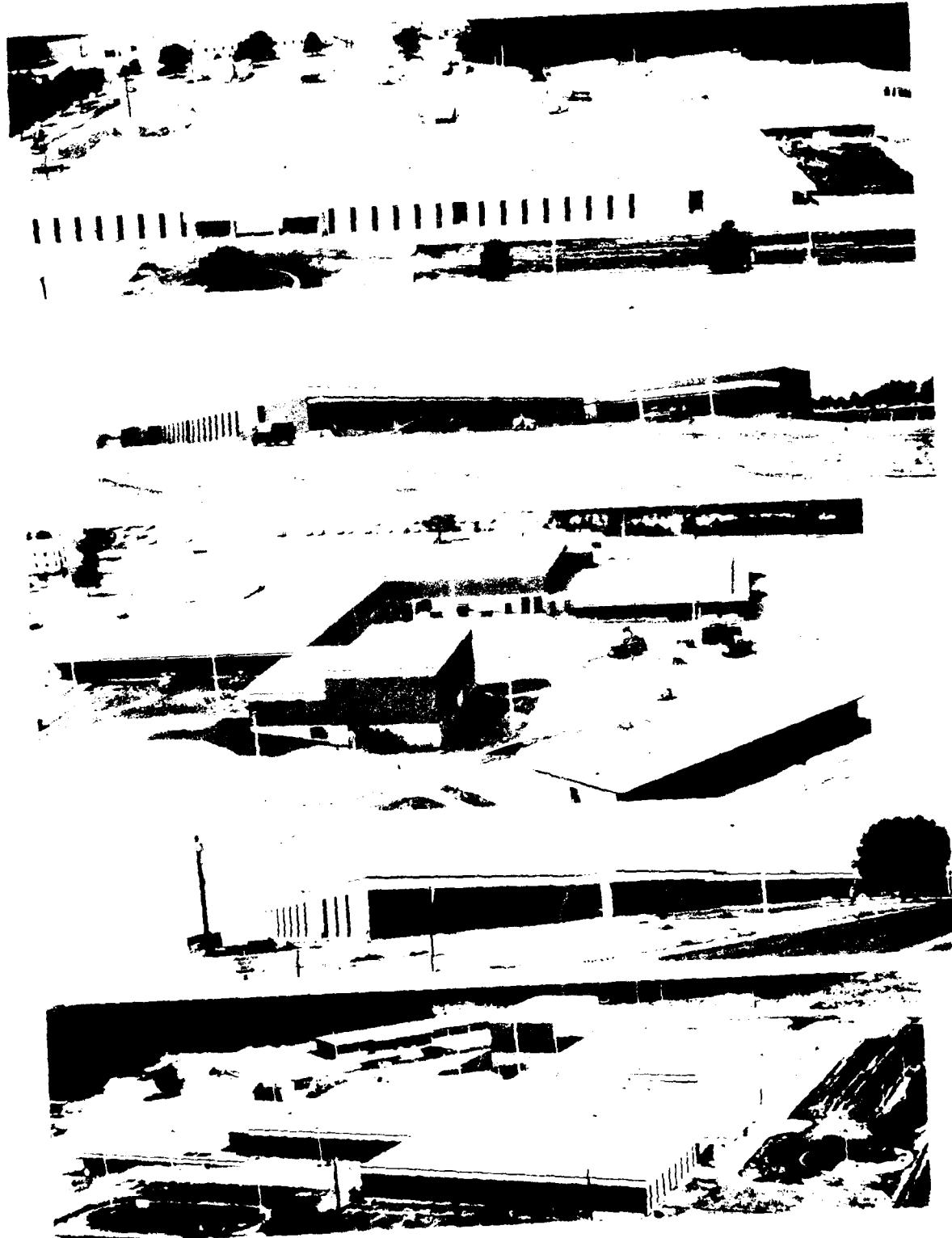
Meritorious Service Medal	3
Army Commendation Medal	5
DA Certificate of Achievement	3
Master Aviator Wings	2
Senior Aviator Wings	1
Air Medal	1

## **Promotions**

Officer	7
Enlisted	28
Civilian	3

## **Special Recognition**

SP4 Gerald Rogen	USAARL Soldier of the Year
COL S. C. Knapp	Award of "A" Professional Designation
SFC G. Johnson	Command and General Staff College, Commandant's List
Sybil Bullock	USAAVNC Commanders Award



# **USAARL'S New Facility**

The hopes and expectations of being moved into the new laboratory at the end of FY 80 have gone. As in the construction of all large buildings, the unexpected has become commonplace and "firm" moving dates are adjusted. But the excitement and anticipation grow as we see the carpet put down, prepare equipment for moving, and watch as white lines begin appearing on the freshly asphalted parking areas. Soon, soon we'll be in the new laboratory.

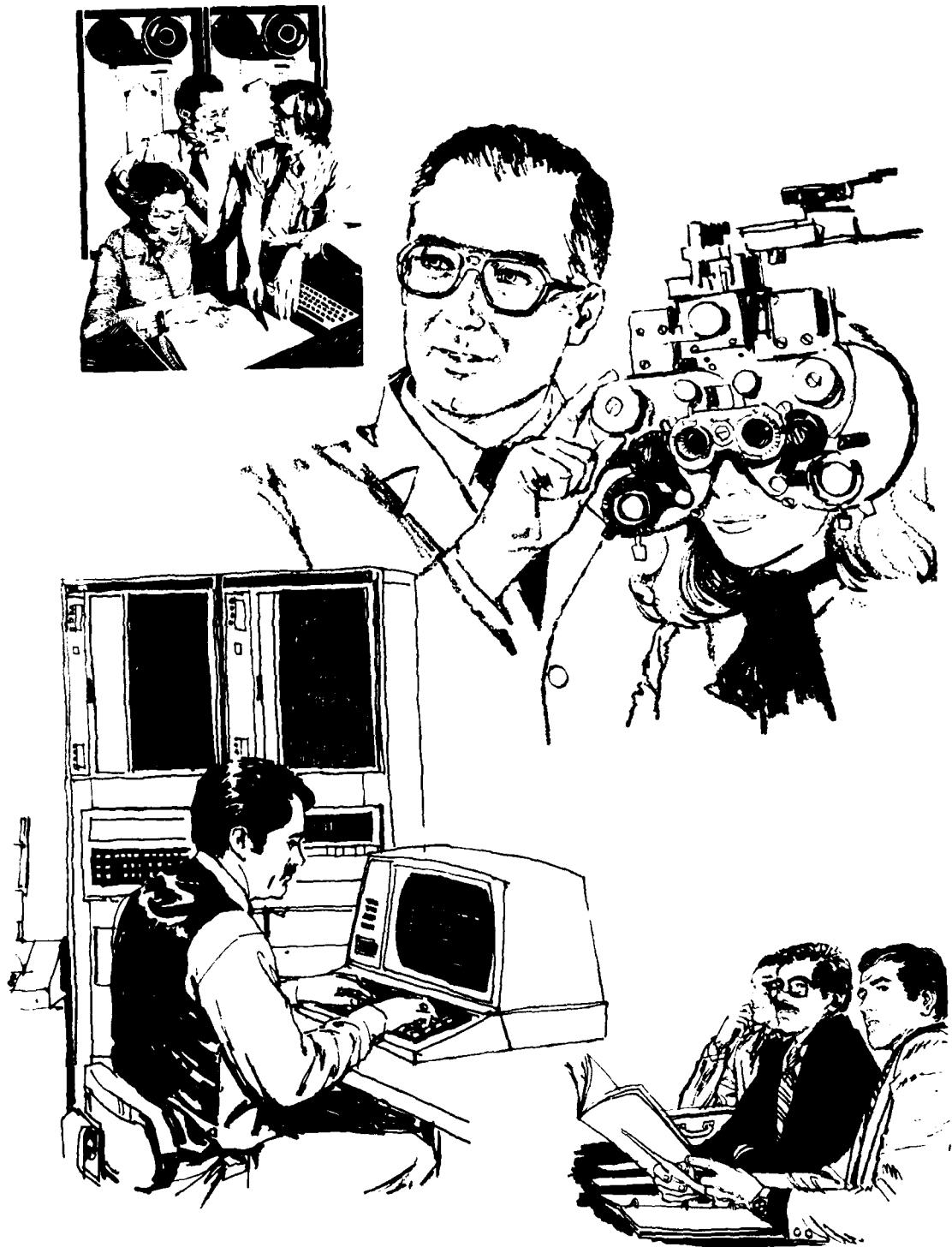
## **Vital Building Statistics**

Date of Contract	28 April 1978
Ground Breaking	2 May 1978
Construction Began	12 May 1978
Size	116,626 sq. ft.
Cost	\$7.5 million
Estimated completion	September 1981

## **Vivarium Expansion**

Construction Began	3 November 1980
Size	3,899 sq. ft.
Estimated completion	15 November 1981





# Scientific Programs

Work continued under the scientific programs established in FY 79. Constrained FY 80 funding required internal reprogramming and redirection of several key research projects. Progress was not halted, but it was slowed.

The close of FY 80 was the time to look closely at and to evaluate the scientific programs USAARL had been working under for the past two years. The combining and adjustment of some projects are evidenced by the termination of four DD Form 1498s, changes in title of others, and the beginning of five new DD Form 1498s for FY 81.

On pages 71-77 is a bibliography of publications, presentations, and reports pertaining to the scientific programs.

The DD Form 1498s terminated at end of FY 80 were:

Research of Electro-Optical Systems and the Human Visual System, DAOB 6892.

Research of Visual problems Medically Significant to the Army, DAOB 6891.

Aeromedical and Physiological Research for AircREW Selection, Retention, and Bio-Tolerance Standards, DAOB 6895.

Direct Field Support to Immediate Army Aeromedical and Ground Vehicle Problems, DAOG 0162.

The DD Form 1498s to begin in FY 81 are:

Physiology and Psychophysics of Information Transfer in the Visual System, DAOG 5999.

Auditory Effects of Blast Overpressure, DAOG 5998.

Vibration Hazards of Combat Aircraft and Vehicles, DAOG 6100.

Parametric, Multimodel Workload Assessment in Simulated Aircraft Guidance Systems, DAOG 6101.

Anthropometric Criteria for Army Aviators, DAOG 6102.

## LIST OF 1498's

TITLE	DA ACCESSION	PROGRAM ELEMENT, TASK AREA, WORK UNIT NUMBER	FY 80	FY 81
			PROGRAM ELEMENT, TASK AREA, WORK UNIT NUMBER	PROGRAM ELEMENT, TASK AREA, WORK UNIT NUMBER
Research of Electro-Optical Systems and the Human Visual System	DAOB 6892	6.27.73.A 00 003	6.11.02.A 00 028	Terminated
Research of Visual Problems Medically Significant to the Army	DAOB 6891	6.27.73.A 00 002	6.27.73.A 00 002	Terminated
Aeromedical and Physiological Research for Aircrew Selection, Retention, and Biomedical Tolerance Standards	DAOB 6895	6.27.72.A 00 007	6.27.72.A 00 007	Terminated
Direct Field Support to Immediate Army Aeromedical and Ground Vehicle Problems	DAOG 0162	6.27.73.A 00 005	6.11.02.A CB 283	Terminated
Physiology and Psychophysics of Information Transfer in the Visual System	DAOG 5999	6.12.77.A AA 156	6.27.77.A AD 152	
Auditory Effects of Blast Overpressure	DAOG 5998	6.27.77.A BH 165	6.27.77.A BH 166	
Vibration Hazards of Combat Aircraft and Vehicles	DAOG 1600	6.27.77.A BH 165	6.27.77.A BH 166	
Parametric, Multimodel Workload Assessment in Simulated Aircraft Guidance Systems	DAOG 6101	6.11.02.A 00 026	6.11.02.A CB 282	
Anthropometric Criteria for Army Aviators	DAOG 6102	6.27.73.A 00 050	6.27.77.A AC 155	
Military Acoustic Hazards: Mechanisms of Hearing Loss	DAOB 6889	6.27.73.A 00 015	6.27.73.A 00 014	
Medical Assessment of Hearing Protective Devices	DAOB 6886	6.27.73.A 00 015	6.27.73.A 00 014	
Military Visual Problems: Assessment, Mechanisms, and Protection	DAOB 6893	6.27.73.A 00 005/004	6.27.77.A BG 164	
Research Directed at Biomedical Parameters Affecting Aircrew Workload during Sustained Operations	DAOG 0153	6.27.73.A 00 001	6.27.77.A BH 161	
Visual Performance Research Related to Operational Problems in Army Aviation	DAOG 0156	6.27.73.A 00 010	6.27.77.A BH 162	
Aeromedical Research of Operationally Significant Problems in the Army Aviation Environment	DAOG 0151	6.27.73.A 00 020	6.27.77.A BH 165	
Biodynamics of Impact Physiology	DAOD 6735	6.27.72.A 00 015	6.11.02.A CB -81	
Research Countermeasures for Significant Medical Hazards in Military Systems	DAOG 0165	6.27.73.A 00 014	6.27.77.A AC 155	
Biomedical Application and Health Hazard Assessment of Oxygen Enrichment Breathing Systems	DAOG 0169	6.27.73.A 00 047	6.27.77.A AC 154	
Biodynamics of Life Support Equipment and Personnel Armor	DAOG 0167	6.27.72.A 00 013	6.27.77.A AC 151	

# Acoustics Program

**Background** High level impulse noise is a uniquely military problem. Artillery systems' impulse noise levels are in excess of any previously studied. Lightweight, high speed combat vehicles generate high-intensity, low-frequency noise which interferes with communications and for which hearing protective devices may not provide needed levels of attenuation. The interaction of vibration, low-frequency noise, and impulse noise is suspected of producing hearing hazards.

**Objective** The objectives of the acoustics program are: to establish valid damage risk criteria; to insure the adequate hearing protection of Army personnel exposed to continuous noise; to assess the sound-attenuating characteristics of passive and active hearing protective devices; to establish the hearing protective devices suitability for Army needs; to develop new hearing protective devices; to determine laboratory and field techniques for evaluation; and to investigate any associated medical effects on audiologic performance.

**Achievements** The effects of 31.5 Hz and 250 Hz octave band noise of chinchillas' hearing thresholds and any resultant histological injury were studied during FY 80. Also, the role of peak pressure in the effects of impulse noise on hearing threshold and histological injury was examined. A final report is in preparation.

Guinea pigs were used as subjects in a study of the role of pigmentation in susceptibility to hearing loss. Two exposures to 1.0 kHz octave band noise were completed. Data from this study is being analyzed for use in a report.

A study was begun to determine the audiogram of miniature swine. A procedure to train the miniature swine to give an audiogram was developed; however, an audiogram was not achieved.

Evaluations of the real ear attenuation characteristics were completed of the SPH-4 helmet manufactured by Acqua-Aire, of the DH-140 helmet, and of several muffs and ear-plugs. Results of

the DH-140 helmet evaluation are given in USAARL LR 80-9-2-5. "Attenuation Variation Obtained with Training when Utilizing an In-the-Ear Hearing Protective Device" was reported in USAARL Report No. 80-6. A soon to be published report will give an assessment of the real-ear attenuation and electroacoustic characteristics of three hearing protectors.

Work continues on development of a method to measure the sound attenuation characteristics of circumaural hearing protectors by physical method.

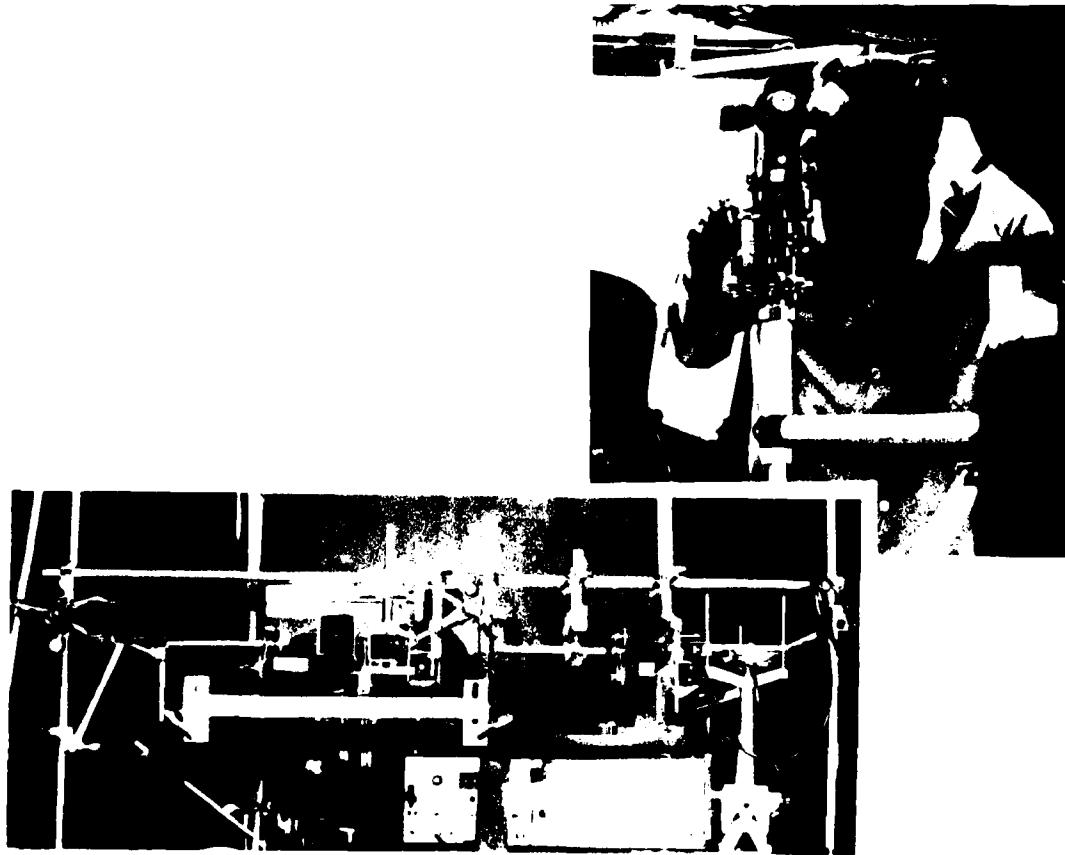
**DD 1498s** This work was carried on during FY 80 under two 1498s. A third 1498 has been initiated for FY 81.

Military Acoustic Hazards, Mechanisms of Hearing Loss, DAOB 6889.

Medical Assessment of Hearing Protective Devices, DAOB 6886.

Auditory Effects of Blast Overpressure, DAOG 5998.

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# Visual Physiology and Psychophysics Program

**Background** A mechanized society demands an efficient information transfer to the human equipment operator. The primary means of acquiring information is through the human visual system. To ensure efficient information transfer in the highly mechanized operational military environment, we must have information concerning the capabilities and limitations of the human visual system and, especially, the impact on visual performance of military operations, environment, and equipment.

**Objective** This program's objectives are to develop methods to assess visual problems created by the military environment, to establish the underlying mechanisms of the problems, and to evaluate the methods of protection and enhancement of the visual system. Another objective is to provide information about the effects of military electro-optical viewing and display systems on the human visual system and to determine optimum display characteristics to match the capabilities of the visual system.

**Achievements** A light control film was found to effectively prevent instrument panel reflections of both the pilot's and copilot's panel in their side transparencies. However, the pilot still saw the reflections of the copilot's instrument panel. We determined that modifications can make the primary lighting system presently used in Army aircraft compatible with the second generation night vision goggle.

We are continuing work on the development of a laboratory and field test procedure to quantify the modulation contrast degradation due to image smear. Previous instrumentation and software procedures have resulted in a system of low repeatability and low bandwidth. New techniques for dynamic sampling and an alternate method of stimulus presentation are being developed. This third generation system will identify the degradation in electro-optical systems as a result of target/sensor dynamics.

A mathematical-computer model of the visual system's transient response to short photic pulses was devised.

**DD 1498s** The work of this program was carried out under three DD 1498s in FY 80. At the close of the fiscal year, two of the 1498s were terminated and the third's title was changed to more accurately reflect work being done.

Research of Electro-Optical Systems and the Human Visual System, DAOB 6892, terminated.

Research of Visual Problems Medically Significant to the Army, DAOB 6891, terminated.

Visual and Optical Evaluation of Nonmedical Material, DAOB 6893, title changed to: Military Visual Problems: Assessment, Mechanisms, and Protection, DAOB 6893.



# Sustained Aviation Operations, Crew Workload, and Stress Program

**Background** Commanders must have the capability to objectively judge aircrew fatigue if the Army's around-the-clock performance capability requirement is to be met. Helicopter flight at or below treetop level day and night, self-deployability of aviation assets from CONUS overseas to combat zones, and night vision sensors and target acquisition systems that extend man's visual capabilities are some of the military developments that may overtax pilot workload, stress, fatigue, and safety levels. Aeromedical data is required to define psychological and physiological capabilities and limits of soldier tolerance to operational stressors, military hardware, advanced tactics, and progressive military operations.

**Objective** One objective of this program is to provide to Army aviation information regarding the visual performance of fixed and rotary wing aviators during varying tactical missions. This visual performance information emphasizes the objective quantification and interpretation of these data and their relation to variables such as pilot physiological states, pilot psychological states and task loading. Another objective is to assess the biomedical parameters which affect aviation personnel during sustained military operations. To provide definitive assessment of medical problems peculiar to the aviation environment and to prepare guidelines for field commanders on the impact of these problems on the aviation mission are further objectives of this program.

**Achievements** Data collected during extended flight in a simulator is being analyzed. Data collection for the study on the effects of extended use of the night vision goggles on helicopter pilots is complete.

The computer data base has been expanded to include the effects of aircraft stability, pilot currency, and pilot experience on aviator visual performance. Current efforts are directed at expanding the computer base to include multipsychophysical and external stimuli efforts in aircrew visual performance/workload.

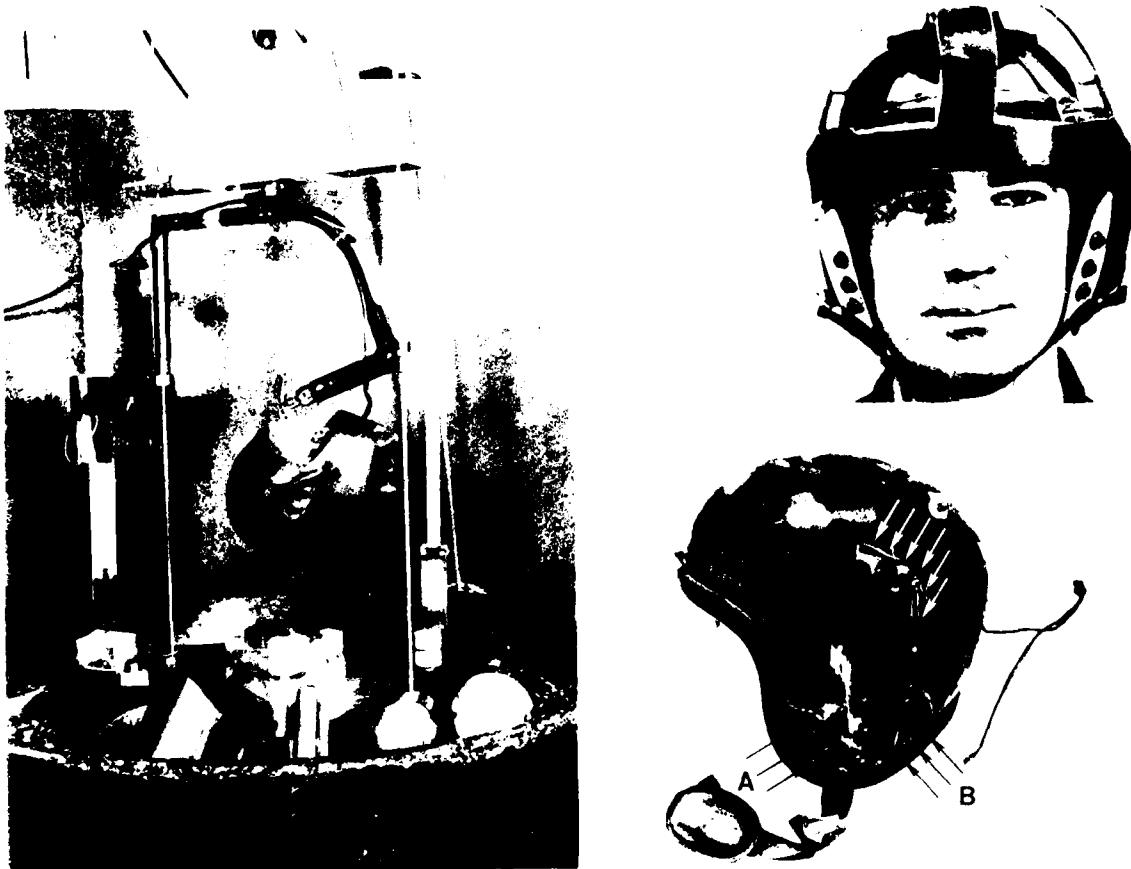
Critical pilot visual requirements for a subminiature heads-up display concept were identified. Five articles were published in the US Army Aviation Digest on aspects of visual performance workload. In response to a request from The Surgeon General, a plan was developed to minimize or eliminate compatibility problems between the night vision goggles and certain ametropic aviators. New dark adaptometers were investigated for applicability as a screen device and as a sensitivity determiner. One hundred eighteen prelaser exposure eye examinations were done in support of establishing baseline data prior to operational training with tactical aviation equipment.

**DD 1498s** Work under this program was performed under three 1498s.

Research Directed at Biomedical Parameters Affecting Aircrew Workload During Sustained Operations, DAOG 0153.

Visual Performance Research Related to Operational Problems in Army Aviation, DAOG 0156.

Aeromedical Research of Operationally Significant Problems in the Army Aviation Environment, DAOG 0151.



# **Impact Physiology in Support of Crashworthiness and Personal Armor Development Program**

**Background** Today's injury studies indicate that approximately one out of three fatalities in Army aviation accidents is due to head and/or neck injury. Research on the mechanisms of head injury (including concussion) in crown impacts, parietotemporal impacts, and facial impacts is still needed even though skull fracture tolerance is fairly well known. The tolerance to impacts from other than forward or vertical directions is still largely unknown. The military community needs to know the tolerance of the body to combined downward, forward, and sideward impacts as faster ground and flight vehicles are creating a more severe impact environment. Personal aircrew armor has been conceived that will stop higher velocity and larger mass projectiles with a minimum increase in weight of the armor. The kinetic energy found on the rear surface of armor which has defeated a projectile has the potential, if not attenuated, to cause significant blunt trauma from the shock wave.

**Objective** An objective of this program is to provide valid, meaningful biomedical criteria for the development of improved injury criteria for design of equipment for head protection and for personal armor. Other objectives are to develop the means to assess helmet protective performance, to develop predictive models of injury, and to develop injury criteria to be used in the development of improved fire protective clothing.

**Achievements** The post-crash thermal injury math model contract was completed and a paper summarizing the work was presented at the May 80 Aerospace Medical Association Annual Scientific Meeting. Helmet energy-absorbing foams and exterior shells were evaluated and 90 percent of the evaluations are complete. Based on Aviation Safety Center and retrieved helmet data, an aviator's head injury study was done. A paper entitled "U.S. Army Aircrewman Head-Neck Injury Experience, 1972-79" was presented at the Aerospace Medical Association Annual Scientific Meeting in May 1980.

**DD 1498s** Work pertaining to this program was done under one 1498. The title of the 1498 was changed at the end of FY 80 to more accurately reflect the work of the program.

Research of Bioengineering Problems Medically Significant  
to: Biodynamics of Impact Physiology, DAOD 6735.

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# Health Hazard Assessment Program

**Background** Today's combat environment presents an array of ever changing health hazards. More sophisticated and complex equipment, changes in operational doctrine and tactics, and threat nations capable of using nuclear, biological and chemical weapons place additional stress on aviation and combat vehicle crewmembers. Man's ability to effectively perform and survive under these additional stressors is limited and must be augmented. The loss of experienced crewmembers is costly and reduces combat effectiveness. Therefore, the health hazard assessment program is necessary to identify, evaluate, and eliminate the health hazards imposed by today's combat environment.

**Objective** The health hazard assessment program is planned (1) to identify, assess and prevent unnecessary health hazards and personnel injuries imposed by exposure to the operational environment, toxic gases, oxygen levels, and chemical and biological agents; (2) to provide the Army technical information, recommendations and standards to be used in the development and modification of systems that provide protection from those hazards; (3) to provide a technological data base concerning the physiological and biomedical aspects of the evaluation and injury correlation of life support equipment; (4) to identify hazard protection problems associated with life support equipment; (5) to provide conceptual design recommendations and criteria for improvement of life support equipment.

**Achievements** The analysis of data on the acceleration/deceleration impact hazard assessment of ground combat vehicles and establishment of impact test criteria and methodology for the new combat vehicle crewman protective helmet was completed and reported in USAARL LR-80-8-3-5. A draft test plan for the assessment of the medical hazards and operational constraints associated with the use of NBC protective clothing has been written. Tri-service and tri-nation (US, Canada, UK) coordination is established.

A report, summarizing helmet damage and resulting injuries, will provide supporting rationale for proposed requirements for future flight helmets. Five case studies were prepared from the

54 ESERF proto received. Helmets have been received from the Air Force and from the Navy for analysis. Each helmet's performance was evaluated and the results sent to the Air Force and Navy in accordance with the tri-service life support equipment retrieval agreement.

Human use approval has been granted the test plan for the biological evaluation of two state of-the-art molecular sieve oxygen generating systems. Initial altitude chamber tests of the system are completed and flights to calibrate and validate the data acquisition system continue. Early results have been reported at the Aerospace Medical Association annual meeting, at a tri-national tri-service conference, and in USAARL LR 80-10-5-6.

**DD 1498s** Four 1498s supported this program during FY 80. At the end of FY 80 one 1498 was terminated and the title of another was changed.

Research Countermeasures for Significant Medical Hazards in Military Systems, DAOG 0165.

Biomedical Application and Health Hazard Assessment of Oxygen Enrichment Breathing Systems, DAOG 0169.

Life Support Equipment Retrieval Program, DAOG 0167, title changed to: Biodynamics of Life Support Equipment and Personnel Armor, DAOG 0167.

Direct Field Support to Immediate Army Aeromedical and Ground Vehicle Problems, DAOG 0162, terminated.



# Medical Aspects of Crew Selection Program

**Background** USAARL has been intimately involved with both the development changes and the applications of physical standards--particularly for Army aviators--for many years. Numerous research projects have been conducted to provide a data base leading to possible modification or clarification of existing regulations. In response to requests from outside agencies (the Army Aeromedical Activity in particular) personnel of this laboratory have conducted consultations involving the application of physical standards. These consultations included vision, cardiovascular, auditory, pulmonary, psychological, anthropometric and vestibular problems. Although these consultations were performed informally, a formal request for assistance was received by the Office of The Surgeon General in September 1977 from the Vice Chief of Staff, DA, through BG C. Canedy, Acting Director of Requirements and Army Aviation Officer, and BG R. Sweet, Deputy Director of Military Personnel Management. The purpose of their request was to determine the minimum, definable, measurable requirements that must be possessed by an applicant to pilot and employ Army aircraft. Coordinated by the Army Research Institute at Fort Rucker, this effort was planned with the assistance of USAARL personnel as directed by AMRDC. The research plan consisting of methods, required funding, and manpower, was presented to appropriate DA staff. USAARL continues to work on certain aspects of this problem area.

**Objective** The objective of this program is to determine biomedical criteria for selection, retention and physical standards for military personnel which are relevant to the operational requirements of the Army's mission. Specific goals are to: (1) determine validity of selected visual standards as applied to Army aviators and other aircrew personnel in the operational environment; (2) analyze the anthropometric differences of the male and female performance in the aviation environment; (3) better define the relationship and necessity for standard audiometric testing and auditory perception of voice communication; and (4) develop psychomotor/psychological tests applicable to crew selection and retention.

**Achievements**    Statically determined linear anthropometric criteria have been determined for the US Army's principal rotary wing aircraft. These have been provisionally incorporated into AR 40-501. A relatively long term in-flight validation is being undertaken by ARL. Approval to continue the evaluation to address maximum anthropometric criteria, and strength and weight criteria was given in October 1980; however, no funding has been provided.

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# Biomedical Aspects of Vibration Program

**Background** Low mass advanced tracked vehicles operating at higher speeds expose restrained crews in unusual seating positions to direct coupled vibration. The resultant effects on the visual, auditory, vestibular and neuromuscular function are not fully known inasmuch as the exposure factors are unique to emerging military weapon systems. The vibration program was initiated in response to a need for preventing vibration related musculoskeletal disorders in Army aviators. Its scope has been expanded to include the prevention of all vibration related disease and human ineffectiveness caused by Army materiel. DOD Scientific and Technical Objectives and Goals Document, AR 10-5, and AR 602-1 establish the requirements for this mission.

**Objective** Vibration affects the body in two hazard areas: health and effectiveness. The general goals of the vibration program are to define these effects and determine a means to alleviate detrimental influences of vibration exposure. Specific goals are to: define the effect of vibration on the neuromuscular control system; determine the role of vibration in producing trauma in joints and bone; determine the effect of vibration on visual acuity and trauma to the eye; determine the effect of vibration in producing hearing loss; and recommend standards which limit vibration exposure to non-hazardous levels.

**Achievements** Initial start-up work conducted under reimbursement from the High Survivability Test Vehicle-Light (HSTV-L) program was used to validate the concept and need for this research. The first in a series of experiments using human volunteers was completed. The experiment demonstrated that significant (+500%) increases in neck muscle occurred in the full supine seat position when the volunteer lifted his head to isolate it from the vibration of the headrest. Lesser increases in neck muscle stress occurred as the seat back angle approached vertical. Vibration of the head of the volunteer was greatly reduced at frequencies above 10 Hz where he lifted his head off the headrest. At lower frequencies the vibration of the head was only moderately reduced by lifting the head. Further research will be conducted as part of the in-house effort.

**DD 1498s** This was a customer-funded project.



# **Technical Participation**

## **Information Exchange**

Participation with the other military services and with international groups in projects of mutual interest benefits us scientifically and economically. There is no problem with which we are involved that does not mesh somehow with that of another group.

Working with interservice and international groups provides for the effective interchange and availability of scientific and technical information needed to support the management and execution of our research program. Membership in and association with these groups furthers USAARL's technology exchange.

## **International**

### **Air Standardization Coordinating Committee (ASCC) Working Party 61**

The Air Standardization Coordinating Committee (ASCC) Working Party 61 is an international organization of the English speaking nations which addresses aerospace medicine and life support. Emphasis is placed on standardization, interoperability and technology exchange. Member nations include the United States, Canada, United Kingdom, Australia, and New Zealand. Although the US Army is not an official member of ASCC at this time, the Army Medical Department has actively participated in and subscribed to the activities and standards of ASCC Working Party 61.

The ASCC is comprised of several committees, each oriented toward a different general area of interest. These include: Altitude Protection, Escape Equipment, Biodynamic Stress (including noise and vibration), Anthropometry, Thermal Stress and Injury, Vision, and NBC Aircrew Protection.

Standardized agreements resulting from Working Party 61 deliberations when ratified are binding upon member nations of ASCC. A significant number of these agreements directly affect aeromedical responsibilities toward Army aviation. Since many of the Advisory Publications and Air Standards impact upon and require adherence by Army aviation, it is necessary for Army aeromedical personnel to participate in the formulation of these standards.

### **AGARD--Aerospace Medical Panel**

This panel was established in May 1952 as one of four panels of the NATO Advisory Group for Aerospace Research and Development. It is concerned with the exchange of information on aerospace medical research and development, the operationally-oriented requirements of clinical aerospace medicine, the provision of advice in human engineering problems, and the stimulation of new research activities to assist the human pilot in his performance. Under this panel are subcommittees concerned with the specific problems of behavioral sciences, biodynamics, special clinical and physiological problems in military aviation and special senses.

USAARL has been an active participant with this panel since 1963. Members of the laboratory serve on AMP subcommittees.

### **German Flight Surgeon Liaison Visit**

In August there was a liaison visit of four weeks by a German Air Force research flight surgeon. During this period, through a cooperative effort of USAARL, the Civil Aeromedical Institute, and the German flight surgeon, a program of acceleration and impact testing of a new German UH-1 helicopter seat design was successfully completed. Our German guest was also briefed on various other aspects of research being conducted at USAARL and arrangements were made for him to visit selected activities at Fort Rucker. We hope this visit will begin a succession of exchange visits between USAARL and various research installations in the Federal Republic of Germany.

## **Test Participation Agreement UK Mask**

There is increasing evidence that chemical and/or biological agents will be used on the modern battlefield. Army aviation aircrew members and ground support personnel must be equipped with protective devices to reduce the risk of operating in the chemical/biological environment (CB).

USAARL has evaluated various proposed personnel protective devices for their biomedical compatibility with the aviation environment since 1976. In 1977, USAARL negotiated a Test Participation Agreement (TPA) with the Institute for Aviation Medicine, Farnborough, England, through Working Party 61 of the Air Standardization Coordinating Committee. As a result of this TPA, USAARL is preparing to conduct a "Physiological Assessment of the United Kingdom Aircrrew NBC Protective Clothing Ensemble." This study will include laboratory tests of the visual and acoustical properties of the AR-5 respirator and flight tests to assess the entire ensemble's effect on pilot performance and pilot thermal physiology (heat stress). The UK ensemble will be compared with the standard US NBC ensemble and the standard flight suit. The first phase of the study in which the thermal insulation properties of various ensembles were to be determined using an instrumented copper mannikin has been completed by Dr. Ralph Goldman at ARIEM, Natick Labs, Natick, Massachusetts. In-house laboratory tests on visual and acoustical properties will begin in the winter quarter with flight tests to follow in the spring and summer of 1981.

## **Interservice**

### **Tri-Service Life Support Equipment Retrieval Program Analysis**

USAARL conducts a tri-service life support equipment retrieval program which brings us crash damaged helmets, seats, and flight clothing for analysis and study. Helmets are the items most often received from the Air Force and Navy.

Army aviation life support equipment involved in either injury causation or prevention, in the field, are sent to USAARL for biomedical and injury correlation evaluation. The evaluation assesses the effectiveness or deficiencies of the life support equipment through an analysis of the physical condition of the protective devices, the human injury incurred, and the related human dynamics involved in the accident.

Data collected through the LSE Program helps identify hazard protection problems associated with the equipment. Also, this data enables us to provide injury reducing design recommendation and health criteria for the improvement of life support equipment. The Navy Medical Department maintains a permanent position for a Navy aerospace physiologist at USAARL to support this program. The Air Force has contributed a senior enlisted life support equipment technician to this program.

### **Army/Air Force/Navy Back Injuries**

This tri-service program is monitored by the Air Force Aeromedical Laboratory at Wright-Patterson AFB. The program was initiated in 1979 with a contract to Wayne State University to expose human surrogates to known multi-axis acceleration. The test subjects are exposed while seated in: (a) shock-absorbing pilot seats (UH-60 type), Black Hawk, and (b) ejection seats of several types. The objective of these tests is to determine spinal vertebra fracture threshold values under several pulse shapes and vector directions.

### **Tri-Service and NASA Human Factors Engineering Technical Advisory Group**

Because of the diversity of subject matter covered by the human factors engineering discipline, the scope of technical areas addressed by the Technical Advisory Group (TAG) is necessarily broad. In general, HFE, as defined for purposes of TAG operation, deals with concepts, data, methodologies, and procedures which are relevant to the development, operation, and maintenance of hardware and software systems. Subject matter subsumes all technologies aimed at understanding and defining the capabilities of human operators and maintainers and insuring the integration of the human component into the total systems to enhance systems effectiveness. Technologies directed toward improved manpower utilization through selection, classification, and training are included as appropriate.

TAG provides a mechanism for exchange of technical information in the development and application of HFE technology. This group enhances the coordination among Government agencies and encourages in-depth technical interaction among subgroups in selected topical areas. TAG assists as required in the preparation and coordination of tri-service documents such as Technology Coordinating Papers and Topical Reviews.

### **Tri-Service Aeromedical Research Panel**

The Tri-Service Aeromedical Research Panel (TARP) was established in 1976 for the purpose of reviewing the overall joint research programs and submitting recommendations to the appropriate service headquarters regarding resources which should be devoted to problems identified with, or anticipated as being important to, aviation medicine. The TARP consists of 12 members which include two laboratory representatives from each service; one Surgeon General representative from each service; one representative of the US Army Medical and Development Command; one representative of the Naval Medical Research and Development Command; and one representative of the Headquarters, Air Force Aerospace Medical Division, or Headquarters, Air Force Systems Command. COL Stanley C. Knapp, Commander, US Army Aeromedical Research Laboratory, has been the chairman of this panel for the past two years.

In 1979, the TARP created the first of several technical working groups (TWG) for the purposes of interacting at the bench level, improving technology exchanges, and working toward the development of viable inter-service cooperative research programs. The first such TWG to be chartered was the TWG for Biodynamics: The Human Effects of Vibration-Impact and Acceleration. The overall objective of this TWG is to provide a coordination process for close and continuing interaction and information exchange at the technical/scientist level in the indicated areas of research and development considered as Technology Base (6.1, 6.2, 6.3 research programs).

### **Onboard Oxygen Generating System (OBOGS)**

Man has specific, well-defined physiological limits of exposure to altitude without supplemental oxygen supplies. These physiological limits are adversely affected by smoking, lung disease and other psycho-physiological factors. Based on these limitations, US Army Regulation AR 95-1, "Army Aviation: General Provisions and Flight Regulations,"

requires that aircrew members engaged in planned flight in unpressurized aircraft above 10,000 feet mean sea level utilize supplemental oxygen to reduce the probability of hypoxia. New mission scenarios requiring nap-of-the-earth (NOE) in mountainous terrain, particularly at night, will increase the need for oxygen at even lower altitudes to prevent performance degradation.

Since 1977, early prototype configurations of onboard oxygen generating systems (OBOGS) using pressure swing molecular sieve technology have been evaluated by the Naval Air Development Center (NAVAIRDEVCEN), the Air Force School of Aerospace Medicine (USAF-SAM), and the US Army Aeromedical Research Laboratory (USAARL).

More recently USAARL has initiated a study entitled "Physiological and Environmental Assessment of Molecular Sieve Aircraft Onboard Oxygen Generating Systems," in which two state-of-the-art OBOGS units are being evaluated in hypobaric chambers at USAF-SAM and USAARL and in the UH-1H and RU21-G aircraft. The first phase of the study involving tests in the hypobaric chamber at the USAF School of Aerospace Medicine was completed in the summer of 1980 with the help of USAF-SAM staff and Dr. John Ernsting of the Institute of Aviation Medicine, Farnborough, England.

The flight phase of the study is being conducted using USAARL fixed and rotary wing aircraft. Close ties are maintained with USAF-SAM through a USAF liaison office at USAARL manned by MSGT Hiott, a specialist in oxygen equipment.

## **Consultations**

Another area of information exchange results from technical consultations and visits. These visits represent a two-way flow of information with USAARL providing and receiving technical information and assistance regarding research programs of mutual concern. These interchanges serve as a means for USAARL to give immediate response to problem areas. This helps in identifying problems and developing solutions. Some of the subjects personnel came to USAARL during FY 80 to discuss were:

- Analysis of physical properties of soft contact lens
- UH-60A litter kit crashworthiness
- Man-machine interface for NVG imagery
- Methodology of eye tracking
- Vision standards
- NVG and subminiature display
- AAH-64 coordination
- Anthropometric study
- LDNS-128 engineering
- On board oxygen generating systems (OBOGS)
- Eye laser protection
- Army aviation personnel requirements for sustained operations

USAARL personnel made trips to other groups to discuss or provide assistance on:

- TSW-7 control tower evaluation
- USAARL's areas of research support to the YAH-64 Program Manager
- Coordination with USAFSAM on OBOGS and LSE research
- Joint conduct of OBOGS altitude chamber evaluation
- Vibration research and instrumentation for cadaver drop test
- Anthropometric standards for Army aviators
- Review and secure modified scientific equipment (NAC)
- Instruct in aviation LSE course at National Guard Professional Education Center
- Review of UKNBC equipment display and discuss USAARL's UK project
- Eye exams on personnel potentially exposed to laser energy
- Joint visual research with Coast Guard

Personnel from USAARL served as representative or members on committees or panels such as:

Medical Equipment and Supply Subcommittee Meeting  
of Army Aeromedical Concepts Review Committee (AACRC)

Fifth Department of Defense Human Factors Engineering  
Technical Advisory Group Meeting

Moderator of paper session, 17th Annual SAFE  
Association Symposium

Quarterly Meeting of Aviation Life Support Equipment  
Management Steering Council

Tri-nation, tri-service conference on OBOGS

1980 Review of AF Sponsored Basic Research in  
Environmental Physiology and Biomechanics

Work in the area of technical consultations and visits is a vital and ever increasing part of USAARL's mission. During FY 80 such exchange visits were made on at least 35 different subjects. Well over 200 visits were logged at division level. Providing and receiving technical information in areas of research concern is greatly aided by opportunities to discuss matters of mutual interest with one's colleagues.

## **Academic Participation**

Four members of USAARL hold academic positions with universities, three instruct in the AAMA Flight Surgeon's Course, and one serves as a manuscript, grant and contract reviewer.

### **University of Alabama at Birmingham**

Adjunct Professor of Health Education                   Stanley C Knapp

### **University of Southern California**

Instructor, Man-Environmental Factors in Systems Management (1979-1980)	Aaron W. Schopper
Instructor, Man-Machine in Systems Management (1980)	Gerald P. Krueger
Instructor, Psychological Factors in Systems Management (1979)	Aaron W. Schopper Gerald P. Krueger

### **Louisiana Technical University**

Associate Member Graduate Faculty	Francis S. Knox, III
Affiliate Assistant Professor of Biomedical Engineering	Francis S. Knox, III

### **AAMA Flight Surgeon's Course**

Instructor	Aaron W. Schopper Gerald L. Johnson Lawrence R. Whitehurst
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Isaac Behar serves as manuscript reviewer for Learning and Motivation, and for Animal Learning and Behavior. He is grant reviewer for the National Science Foundation and National Research Council of Canada. Dr. Behar also serves as contract reviewer for the U.S. Army Medical Research and Development Command.

# Committees

<b>Committee</b>	<b>Affiliation</b>	<b>Individual</b>
AEROSPACE MEDICAL ASSOCIATION		
Constitution and Bylaws Committee	Member	COL S. C. Knapp
Scientific Program Committee	Member	Dr. K. A. Kimball
AIR STANDARDIZATION COORDINATING COMMITTEE (INTERNATIONAL)		
Working Party 61 (Aerospace Medicine and Life Support Systems)	Army Representative	COL S. C. Knapp LTC J. K. Crosley
AMERICAN BOARD OF PREVENTIVE MEDICINE (AEROSPACE MEDICINE)		
Professional Examination Committee	Member	COL S. C. Knapp
AMERICAN NATIONAL STANDARDS INSTITUTE		
Z90.1 Helmet Committee	Member	COL S. C. Knapp
Z90.1 Helmet Subcommittee on Helmet Durability	Chairman	COL S. C. Knapp
Z80.1 Ophthalmic Lens Committee	Member	LTC J. K. Crosley
53-62 Working Group on the Effects of Impulse Noise on Man	Member	Dr. J. H. Patterson
Working Group on Real-Ear Attenuation Standards	Member	Dr. J. H. Patterson
DEPARTMENT OF DEFENSE		
Aircrew Station Standardization Panel (Tri-Service)	Member Member	LTC J. K. Crosley MAJ F. F. Holly

<b>Committee</b>	<b>Affiliation</b>	<b>Individual</b>
Group on Specification Problems and Standardization Actions on Audio Devices	Member	Mr. R. T. Camp, Jr.
Helicopter Research Coordinating Panel (Tri-Service)	Chairman Member	Dr. K. A. Kimball COL S. C. Knapp
Human Factors Engineering Technical Advisory Group (Tri-Service)	Member	Dr. K. A. Kimball
Tri-Service Aeromedical Research Panel (TARP)	Chairman Member	COL S. C. Knapp LTC J. K. Crosley
Tri-Service Aerospace Medical Coordination Technical Working Group	Member	Mr. J. L. Haley, Jr.
DEPARTMENT OF THE ARMY		
Advanced Attack Helicopter Alternate System Safety Group	Member	MAJ C. E. Duncan
Aircraft Noise, Working Group (MIL-STD-8806)	Member	Mr. R. T. Camp, Jr.
Army Aviation Personnel Requirements for Sustained Operations, Study Advisory Group	Member	Dr. K. A. Kimball
Biomedical Engineering	Consultant to The Surgeon General	COL S. C. Knapp
Helicopter Medical Human Factors Engineering and Training/Selection Research Coordination Panel	Chairman	Dr. K. A. Kimball
US Army Lighting Advisory Committee	Member	MAJ F. F. Holly
FEDERAL AVIATION ADMINISTRATION		
Seat Committee	Member	COL S. C. Knapp
NATIONAL ACADEMY OF SCIENCES-- National Research Council		
Committee on Vision	Member	LTC J. K. Crosley
Committee on Vision	Member	Dr. I. Behar
Committee on Vision	Member	Dr. J. H. Patterson
Committee on Hearing and Bioacoustics	Member	Mr. R. T. Camp, Jr.

<b>Committee</b>	<b>Affiliation</b>	<b>Individual</b>
NORTH ATLANTIC TREATY ORGANIZATION-- Advisory Group for Aerospace R&D		
Aerospace Medical Panel	U.S. Army Representative	COL S. C. Knapp
Biodynamics Subcommittee	Member	COL S. C. Knapp
Behavioral Sciences Committee, AMP	Member	Dr. K. A. Kimball
Evaluation of Methods to Assess Work-load, AMP Working Group 08	Member	Dr. K. A. Kimball

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Brownell, William S., Holly, Frank F., and Chiou, Wun C., Sr. 1980. *Mathematical formulation and computer analysis of minimization of cockpit reflections*. Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-1-3-1.

Hiott, Bruce F., Hundley, Ted A., and Johnson, Gerald L. 1980. *Review of aviator oxygen masks with MBU 12/P evaluation*. Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-10-3-6.

Holly, Frank F. 1979. *An evaluation of light control film for reducing reflections within the AH-1S aircraft*. Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-2-2-1.

Holly, Frank F. 1980. *A night vision goggle compatible lighting system for Army aircraft*. Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-4-2-2.

Holt, William R. 1979. *Some mathematical investigations of oxygen tension under contact lens, interim report*. Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-3-5-1.

Hundley, Ted A. 1980. *Impact protection requirements for future combat vehicle crewmen's helmets*. Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-8-3-5.

Mozo, Ben, and Murphy, Barbara. 1980. *Real-Ear attenuation characteristics of the DH-140 helmet*. Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-9-2-3.

Stroud, Jonathan P., and Barr, Robert L. 1980. *An evaluation of the toxic gases in the tactical radar threat generator (TRTG) system operator's shelter*. Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-6-3-3.

Stroud, Jonathan P., Barr, Robert R., and Sanocki, Melissa R. 1980. *A re-evaluation of the toxic gases in the cockpit of the OH-58C with infrared exhaust stacks installed.* Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-7-3-4.

Whitehurst, Lawrence R. 1980. *An analysis of fifty-five Army aircraft over-water accidents.* Fort Rucker, Alabama: U.S. Army Aeromedical Research Laboratory. USAARL-LR-80-5-3-2.

# **Appendix**

**Research and Technology Work  
Unit Summaries (DD 1498) for FY80**

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION#	2. DATE OF SUMMARY	REPORT CONTROL NUMBER	
79 10 01	H. Terminate	U	U	DA OB 6892	80 09 30	DD-DR&E(AR)626	
3. DATE PREV SUMMARY				4. KIND OF SUMMARY	5. SUMMARY SCY <sup>6</sup>	6. WORK SECURITY <sup>7</sup>	
7. REGRADING <sup>8</sup>				8. CHG'D IN INSTN <sup>9</sup>	9. SPECIFIC DATA CONTRACTOR ACCESS		
				NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	10. LEVEL OF SUM
							A WORK UNIT
11. NO./CODER <sup>10</sup>				PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER	
a. PRIMARY				6.27-73.A	3E162773A819	00	003
b. CONTRIBUTING							
c. CONFIDENTIAL <sup>11</sup>				CARDS (f) (m)			
12. TITLE (Provide full security classification code)							
(U) Research of Electro-Optical Systems and the Human Visual System							
13. SCIENTIFIC AND TECHNOLOGICAL AREAS							
001300 Aircraft; 012000 Optics; 012900 Physiology							
14. START DATE		15. ESTIMATED COMPLETION DATE		16. FUNDING AGENCY	17. PERFORMANCE METHOD		
76 10		80 09 30		DA	C. In-House		
18. CONTRACT/GRANT				19. RESOURCES ESTIMATE	20. PROFESSIONAL MAN YRS	21. FUNDS (in thousands)	
22. DATE/EXPIRE/TYPE:				INVESTIGATORS			
23. NUMBER <sup>12</sup>				FISCAL YEAR	80	4.7	120
24. AMOUNT:				CURRENT			
25. CUM. AMT.				0	0		
26. RESPONSIBLE DOD ORGANIZATION				27. PERFORMING ORGANIZATION			
NAME <sup>13</sup> : US Army Aeromedical Research Laboratory				NAME <sup>14</sup> : US Army Aeromedical Research Lab Human Tolerance & Survivability Div			
ADDRESS <sup>15</sup> : Fort Rucker, Al 36362				ADDRESS <sup>16</sup> : Fort Rucker, Al 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Provide name if U.S. Academic institution)			
NAME: Knapp, Stanley C., COL, CDR				NAME: Verona, R. W., CPT			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-6808/6415			
28. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
				NAME: Holly, F. F., CPT			
				NAME: Rash, C. E.			
29. REVISED/PREVIOUS DATA (Provide security classification code) (U) Aircraft; (U) Electro-Optical Systems; (U) Vision; (U) Target Detection; (U) Display Color; (U) Visual Sensitivity; (U) Night Vision							
30. TECHNICAL OBJECTIVE <sup>17</sup> ; 31. APPROACH; 32. PROGRESS (Provide individual paragraphs identified by number. Provide full of each with security classification code.)							
23. (U) To provide information about the effects of military electro-optical viewing and display systems on the human visual system and to determine optimum display characteristics to match the capabilities of the visual system.							
24. (U) The approach will involve visual psychophysical procedures and the electro-optically generated targets will be verified with static and scanning photometric and colorimetric techniques.							
25. (U) 7910-8009. Work is continuing on the development of a laboratory and field test procedure to quantify the modulation contrast degradation due to image smear. Previous instrumentation and software procedures have resulted in a system of low repeatability and low bandwidth. New techniques for dynamic sampling and an alternate method of stimulus presentation are being developed. This third generation system will identify the degradation in Electro-Optical Systems as a result of target/sensor dynamics. This project is converted. A portion of the research initiated on this project is continued on 1498 "Military Visual Problems: Assessment, Mechanisms, and Protection" DAOB 6893.							
33. AVAILABILITY TO CONTRACTORS UPON ORIGINATOR'S APPROVAL							
DD FORM 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 68 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE							

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESION#	2. DATE OF SUMMARY <sup>3</sup>	REPORT CONTROL SYMBOL
1. DATE PREV SURVEY	4. KIND OF SUMMARY	5. SUMMARY SCRTY <sup>4</sup>	6. WORK SECURITY	7. REGRADING <sup>5</sup>	8. DDG&M INSTN#	9. SPECIFIC DATA CONTRACTOR ACCESS
79 10 01	H. Terminate	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
				WORK UNIT NUMBER		10. LEVEL OF DUE A. WORK UNIT
				00	028	
				00	002	
				11. TITLE (Pecode Each with Security Classification Code) <sup>6</sup>		
(U) Research of Visual Problems Medically significant to the Army						
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>7</sup>						
001300 Aircraft; 01200 Optics; 012900 Physiology						
13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD			
76 10	80 09 30	DA	C. In-House			
17. CONTRACT/GANT				18. RESOURCES ESTIMATE		
19. DATES/EFFECTIVE:				PRECEDING	20. PROFESSIONAL MAN YRS	21. FUNDS (in thousands)
22. NUMBER: 23. TYPE: 24. KIND OF AWARD:				FISCAL YEAR	80 CURRENT	4.7 142
					81	0
25. RESPONSIBLE DOD ORGANIZATION				26. PERFORMING ORGANIZATION		
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab Human Tolerance & Survivability Div		
ADDRESS: Fort Rucker, Al 36362				ADDRESS: Fort Rucker, Al 36362		
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (FURNISH NAME IF U.S. Academic Institution)		
NAME: Knapp, Stanley C., COL, CDR TELEPHONE: (205) 255-5107				NAME: Holly, F. TELEPHONE: (205) 255-6808/6415		
27. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER:		
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS		
28. KEYWORDS (Pecode Each with Security Classification Code) (U) Aircraft; (U) Vision; (U) Man-Machine Interface; (U) Visual Psychophysics; (U) Night Vision; (U) Visual Correction; (U) Visual Protection				NAME: Behar, Isaac		
29. TECHNICAL OBJECTIVE <sup>8</sup> 30. APPROACH 31. PROGRESS (Pecode individual paragraphs identified by number Pecode last of each with Security Classification Code.)						
23. (U) To provide information about the visual sensory modality relating to capability of the human visual system and the impact of military equipment, environmental and operational influences on visual performance and integrity.						
24. (U) The approach will include psychophysical, electrophysiological, and other objective techniques to evaluate human visual performance with quantitative measures.						
25. (U) 7910-8009. A mathematical-computer model of the visual system's transient response to short photic pulses was devised. A laboratory report and two articles about this work are currently in preparation. This project is discontinued. Portions of the research initiated under this project will continue under new 1498 "Physiology and Psychophysics of Information Transfer in the Visual System".						
Available to contractors upon originator's approval						
DD FORM 1498 1 MAR 68						
PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 65 AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE						

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION <sup>1</sup>	2. DATE OF SUMMARY <sup>2</sup>	REPORT CONTROL SYMBOL			
3. DATE PREV SUMMARY 79 10 01	4. KIND OF SUMMARY H. Terminate	5. SUMMARY SECY <sup>3</sup> U	6. WORK SECURITY <sup>3</sup> U	7. DEGRADING <sup>4</sup> NA	8. DODGEN INSTRN <sup>5</sup> NL	9. SPECIFIC DATA- CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO			
10. NO./CODES <sup>6</sup> a. PRIMARY 6.27.73.A	PROGRAM ELEMENT PROJECT NUMBER 3E162773A819			11. TASK AREA NUMBER 00	12. LEVEL OF SUB- WORK UNIT 007				
b. CONTRIBUTING c. EQUIVALENTS CARDS 114 (f) (m)									
13. TITLE (Purcede each with Security Classification Code) <sup>7</sup> (U) Aeromedical and Physiological Research for Aircrew Selection, Retention, and Biomedical Tolerance Standards									
14. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>8</sup> 001300 Aircraft; 012900 Physiology; 016200 Stress Physiology; 002300 Biochemistry; 012400 Personnel Selection & Maintenance; 009400 Man-Machine Relation									
15. START DATE 76 10	16. ESTIMATED COMPLETION DATE 80 09 30	17. FUNDING AGENCY DA	18. PERFORMANCE METHOD C. In-House						
19. CONTRACT/GRANT	20. EXPIRATION	21. RESOURCES ESTIMATE	22. PROFESSIONAL MAN YRS	23. FUNDS (In thousands)					
a. DATES/EFFECTIVE:	EXPIRATION	b. PRECEDING FISCAL YEAR 80	c. CURRENT 81	d. .0					
d. NUMBER <sup>9</sup>	e. AMOUNT								
f. CUM. AMT.									
24. RESPONSIBLE DOD ORGANIZATION	25. PERFORMING ORGANIZATION								
NAME: US Army Aeromedical Research Laboratory	NAME: US Army Aeromedical Research Lab Human Tolerance & Survivability Div								
ADDRESS: Fort Rucker, AL 36362	ADDRESS: Fort Rucker, AL 36362								
RESPONSIBLE INDIVIDUAL	PRINCIPAL INVESTIGATOR (Purcede each with Security Classification Code)								
NAME: Knapp, Stanley C., COL, CDR	NAME: Harding, T. H., CPT								
TELEPHONE: (205) 255-5107	TELEPHONE (205) 255-5114								
26. GENERAL USE	SOCIAL SECURITY ACCOUNT NUMBER								
Foreign Intelligence Considered	ASSOCIATE INVESTIGATORS								
27. KEYWORD (Purcede each with Security Classification Code)	NAME:								
(U) Aircraft; (U) Pulmonary Physiology; (U) Stress Physiology; (U) Pharmacology; (U) Life Support	NAME:								
28. TECHNICAL OBJECTIVE <sup>10</sup>	29. APPROACH, 30. PROGRESS (Purcede individual paragraphs identified by number. Purcede each with Security Classification Code.)								
23. (U) To determine biomedical tolerance standards for military environments and requirements and to relate these standards to aircrew selection and retention medical criteria.									
24. (U) The approach will include accepted medical, physiological, neurophysiological, and audiological quantitative techniques, using both human volunteers and animal models where appropriate.									
25. (U) 7910-8009. During the past year, several protocols have been approved which deal with cardiopulmonary physiology in Army aviators. The cardiopulmonary laboratory has been staffed and personnel are undergoing extensive training. Evaluations of indirect methods of analyzing blood gases in canines demonstrated inadequacies which were found to be too great to successfully use the canine as an appropriate model for the effects of altitude on blood gases. The neurophysiology laboratory was staffed and nearly completely equipped. Electronic instrumentation associated with animal anesthesia and maintenance, single neuron recording, photic stimulation and data analysis was designed and built. An instrument for rapidly evaluating visual contrast sensitivity in a clinical environment was designed and a prototype constructed. An instrument for positioning microelectrodes on the retina was designed and its construction is partially completed. This project is adjusted. Portions of the research initiated on this project are continued on 1498 "Physiology and Psychophysics of Information Transfer in the Visual System".									
<small>*Available to contractors upon originator's approval</small>									
DD FORM 1 MAR 68 1498	PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE DD FORMS 1498A 1 NOV 68 AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE								

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				AGENCY ACCESSION <sup>9</sup>	DATE OF SUMMARY <sup>10</sup>	REPORT CONTROL SYMBOL	
1. DATE PREV SURVEY	2. KIND OF SUMMARY	3. SUMMARY SECY <sup>11</sup>	4. WORK SECURITY <sup>12</sup>	DA OG 0162	80 10 01	DD DR&E (AR) 636	
79 10 01	H. Terminate	U	U	NA	NL	IN SPECIFIC DATA CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
10. NO. CODES <sup>13</sup>	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		LEVEL OF SUB A. WORK UNIT	
A. PRIMARY	6.27.73.A	3E162773A819		00		005	
B. CONTRIBUTING							
C. CONTRIBUTING							
11. TITLE (Prefix code with Security Classification Code) <sup>14</sup> <b>(U) Direct Field Support to Immediate Army Aeromedical and Ground Vehicle Problems</b>							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>15</sup> <b>016200 Stress Physiology; 002400 Bioengineering; 08800 Life Support</b>							
13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD				
78 10 01	CONT	DA	C. In-House				
17. CONTRACT/GRANT		EXPIRATION:		18. RESOURCES ESTIMATE			
19. DATES/EFFECTIVE				FISCAL	20. PROFESSIONAL MAN YRS	21. FUNDS (in thousands)	
20. NUMBER <sup>22</sup>				YEAR	CURRENT	80 3.4 88	
21. TYPE:		22. AMOUNT			81	0.0 00	
23. KIND OF AWARD:		F. CUM. AMT.		24. PERFORMING ORGANIZATION			
25. RESPONSIBLE DOD ORGANIZATION				NAME: US Army Aeromedical Research Lab Biomedical Applications Research			
NAME: US Army Aeromedical Research Laboratory				ADDRESS: Fort Rucker, Al 36362			
ADDRESS: Fort Rucker, Al 36362				PRINCIPAL INVESTIGATOR (Prefix code with Security Classification Code) NAME: Hundley, T. A., BA, DAC			
RESPONSIBLE INDIVIDUAL				TELEPHONE: (205) 255-7112			
NAME: Knapp, S. C., COL, CDR				SOCIAL SECURITY ACCOUNT NUMBER			
TELEPHONE: (205) 255-5107				ASSOCIATE INVESTIGATORS			
26. GENERAL USE				NAME: Stroud, J. P., CPT, MSC			
NAME: Foreign Intelligence Considered				NAME:			
27. REBORNE (Prefix code with Security Classification Code) <b>(U) Protective Equipment; (U) Stress Physiology; (U) Biomedical Engineering; (U) Man-Machine Relationships; (U) Biochemistry; (U) Life Support</b>							28. TECHNICAL OBJECTIVE <sup>23</sup>
29. APPROACH, 30. PROGRESS (Prefix individual paragraphs identified by number. Prefix code with Security Classification Code.)							31. PROGRESS
23. (U) To provide biomedically pertinent information and solutions to resolve immediate operational field problems in areas related to the interface of the physical and life science aspects of aviation and ground vehicles including evaluations of conceptual proposed and first article equipment and systems.							24. (U) To provide biomedically pertinent information and solutions to resolve immediate operational field problems in areas related to the interface of the physical and life science aspects of aviation and ground vehicles including evaluations of conceptual proposed and first article equipment and systems.
25. (U) The application of physiological and medical evaluative testing techniques, prior research data, and user questionnaires to assess, enhance, and validate equipment and systems proposed to resolve immediate medically related field problems. It will involve laboratory dynamic impact and acoustic noise attenuation test of helmets, field assessments of protective clothing, simulated and field investigations of vehicle seat configurations, flight testing of the medical aspects of rescue equipment and the evaluations of advance aircraft and ground vehicle designs with respect to toxicology, heating, ventilation, downwash and crashworthiness.							26. (U) 7910-8009. Laboratory dynamic impact evaluation tests were performed on six production lots of aviator flight helmets. The second series of tests were performed on a set of pre-production SPH-4's manufactured by a potential second source supplier. The initial production lot testing for this contract was done under contract at an outside laboratory. USAARL observed the testing to insure compliance with the military specification. In the future all production quality assurance testing will be done under contract. Impact tests were conducted on the prototype ballistic shell for the DH-132 armored vehicle crewman's helmet and on the IHADSS helmet for the AAH. Project has been terminated due to change in assignment of principal investigators and support personnel.
32. Available to contractors upon originalator's approval							33. APPROACH
34. FORM DD FORM 1498 1 MAR 68 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 68 AND 1498-1, 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE							35. PROGRESS

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION	2 DATE OF SUMMARY	REPORT CONTROL SYMBOL	
3 DATE PREV SURVEY	4 KIND OF SUMMARY	5 SUMMARY SECY <sup>b</sup>	6 WORK SECURITY <sup>b</sup>	7 REGRADE <sup>b</sup>	8A DOD/IN INSTRN	8B SPECIFIC DATA <sup>b</sup>	9 LEVEL OF SUM
A. NEW	U	U			NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A WORK UNIT
10 MO /CODES <sup>a</sup>	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER	WORK UNIT NUMBER		
B. PRIMARY	6.11.02.A	3M161102BS10		CB	283		
C. CONTRIBUTING							
D. COTRIBUTING	STOC 80-7.2:4						
11 TITLE (Proceed with Security Classification Code) <b>(U) Physiology and Psychophysics of Information Transfer in the Visual System</b>							
12 SCIENTIFIC AND TECHNOLOGICAL AREAS <b>012900 Physiology; 012000 Optics; 002400 Bioengineering</b>							
13 START DATE	14 ESTIMATED COMPLETION DATE	15 FUNDING AGENCY	16 PERFORMANCE METHOD				
80 10	CONT	DA	C. In-House				
17 CONTRACT GRANT							
18 DATES/EFFECTIVE	EXPIRATION	19 RESOURCES ESTIMATE	20 PROFESSIONAL MAN YRS	21 FUNDS (In thousands)			
19 NUMBER <sup>a</sup>		FISCAL PRECEDING	CURRENT	00			
20 TYPE	4 AMOUNT	FISCAL YEAR	80	0.0			
21 KIND OF AWARD:	E. CUM. AMT.		81	165			
22 RESPONSIBLE DOD ORGANIZATION	23 PERFORMING ORGANIZATION						
NAME <sup>a</sup> : US Army Aeromedical Research Laboratory	NAME <sup>a</sup> : US Army Aeromedical Research Lab Sensory Research Division						
ADDRESS <sup>a</sup> : Fort Rucker, AL 36362	ADDRESS <sup>a</sup> : Fort Rucker, AL 36362						
RESPONSIBLE INDIVIDUAL	PRINCIPAL INVESTIGATOR (Name if U.S. Academic Institution)						
NAME: Knapp, Stanley C., COL, MC, CDR	NAME: Harding, T. H., CPT, MSC, PH.D.						
TELEPHONE: (205) 255-5107	TELEPHONE: (205) 255-6808						
24 GENERAL USE	SOCIAL SECURITY ACCOUNT NUMBER						
Foreign Intelligence Considered	ASSOCIATE INVESTIGATORS						
25 KEYWORDS (Proceed with Security Classification Code)	NAME: Holly, F. F., CPT						
(U) Retinal Physiology; (U) Visual Psychophysics; (U) Human	NAME: McLean, W., MAJ						
(U) Visual Performance; (U) Visual Adaptation; (U) Visual Neuropharmacology; (U) Animals							
26 TECHNICAL OBJECTIVE <sup>a</sup>	27 APPROACH <sup>a</sup> 28 PROGRESS (Provide individual paragraphs identified by number Proceed with Security Classification Code)						
23. (U) The primary objective of this research program is to provide quantitative information on the physiological processes and mechanisms which underly visual perception. The ultimate goal of this work is to achieve a depth of understanding of visual functioning that will allow us to predict visual performance and visual requirements under many different operational conditions. This should reduce having to perform ad hoc studies to address each set of conditions individually. Development and user communities often inquire about the effect of certain conditions upon the soldier's visual sensitivity or dark adaptation. A better understanding of these processes will hopefully eliminate expensive separate studies. By exploring the functional properties of retinal and cortical processes which are intimately involved in the transfer and modification of visual information, a quantitative link may be established between neural mechanisms and visual performance. This 1498 incorporates portions of DAOB 6891 and DAOB 6895.							
24. (U) Our approach primarily includes single and multiple neuron recording techniques in animals and evoked potential and psychophysical procedures in human subjects. Results from animals will be used to construct models of the human visual nervous system such that deduction may be drawn in studies where human subjects would be inappropriate due to associated risk (e.g., effects of chemical agents on visual performance). Due to the complexity of the task, a multidisciplinary approach is required which includes (1) neurophysiology, neuropharmacology and neuroanatomy, (2) optical physics, optometry and physiological optics, (3) sensory and engineer psychology, and (4) experimental psychophysics.							
25. (U) None. <small>Available to contractors upon organization's approval</small>							

DD FORM 1498  
1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 65  
AND 1498B 1 MAR 68 FOR ARMY USE ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SECY	6. WORK SECURITY	7. REGARDING	8. ORIGIN INSTRN	9. SPECIFIC DATA CONTRACTOR ACCESS
A. New	U	U		NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
10. NO / CODES	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER	WORK UNIT NUMBER	
B. PRIMARY	6.12.77.A	3E162777A878		AA	136	
C. CONTRIBUTING						
C. CONTRIBUTING	STOG 80 7.2.4					
11. TITLE (Prefix each with Security Classification Code)						
(U) Auditory Effects of Blast Overpressure						
12. SCIENTIFIC AND TECHNOLOGICAL AREAS 000200 Acoustics; 013300 Protective Equipment; 007900 Industrial (occupational) Medicine						
13. START DATE 80 10	14. ESTIMATED COMPLETION DATE CONT	15. FUNDING AGENCY DA	16. PERFORMANCE METHOD C. In-House			
17. CONTRACT/GANT		18. RESOURCES ESTIMATE	19. PROFESSIONAL MAN YRS	20. FUNDS (in thousands)		
21. DATES/EFFECTIVE EXPIRATION		FISCAL YEAR 0	0			
22. NUMBER		CURRENT				
23. TYPE		4. AMOUNT				
24. KIND OF AWARD		E. CUM. AMT.	81	2.2	128	
25. RESPONSIBLE DOD ORGANIZATION		26. PERFORMING ORGANIZATION				
NAME: US Army Aeromedical Research Laboratory		NAME: US Army Aeromedical Research Lab Sensory Research Division				
ADDRESS: Fort Rucker, Al 36362		ADDRESS: Fort Rucker, Al 36362				
PRINCIPAL INVESTIGATOR (Prefix each with Security Classification Code) NAME: Patterson, James H., Jr., Ph.D. TELEPHONE: (205) 255-4408						
SOCIAL SECURITY ACCOUNT NUMBER						
ASSOCIATE INVESTIGATORS NAME: Mozo, Ben T.						
27. GENERAL USE Foreign Intelligence Considered						
28. KEYWORD (Prefix each with Security Classification Code) (U) Acoustics; (U) Protective Equipment; (U) Industrial (occupational) Medicine; (U) Weapons Effects; (U) Impulse Noise; (U) Animals						
29. TECHNICAL OBJECTIVE, 24 APPROACH, 26 PROGRESS (Prefix individual paragraphs identified by number Prefix each with Security Classification Code.)						
23. (U) To define the physiologic effects upon the auditory system of blast overpressure generated by firing Army weapons systems in terms of the physical characteristics of the pressure wave responsible for injury to the auditory system and potential protective devices and mechanisms.						
24. (U) The approach is three prcaged: 1. Physical measurements to define the nature of the noise and on which to base hazard assessment. 2. Direct validation of hearing protective devices and development of indirect methods to determine their adequacy. 3. Basic animal and human studies to develop a data base for more accurate tolerance limits (damage risk criteria) for impulse noise.						
25. (U) None.						
Available to contractors upon contract's approval						
DD FORM 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 68 1 MAR 68 AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE						

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION#	2 DATE OF SUMMARY*	REPORT CONTROL SYMBOL	
A. DATE PREV SUMMARY	B. KIND OF SUMMARY	C. SUMMARY ACTVY	D. WORK SECURITY	DAOG 6100	80 10 01	DD DR&E(AR)656	
				NA	NL	E. SPECIFIC DATA CONTRACTOR ACCESS	F. LEVEL OF SUM
G. NO /CODES*		PROGRAM ELEMENT		PROJECT NUMBER		WORK UNIT NUMBER	
H. PRIMARY		6.27.77.A		3E162777A878		AD 132	
I. CONTRIBUTING							
J. CONTINUATION /		STOG 80 7.2:4					
K. TITLE (Proceed with Security Classification Code)* (U) Vibration Hazards of Combat Aircraft and Vehicles							
L. SCIENTIFIC AND TECHNOLOGICAL AREAS* 007500 Human Factors Engineering; 009400 Man-Machine Relations; 012900 Physiology; 008800 Life Support							
M. START DATE		N. ESTIMATED COMPLETION DATE		O. FUNDING AGENCY	P. PERFORMANCE METHOD		
80 10		CONT		DA	C. In-House		
Q. CONTRACT/GRANT		R. EXPIRATION		S. RESOURCES ESTIMATE		T. PROFESSIONAL MAN YRS	U. FUNDS (\$ in thousands)
V. DATES/EFFECTIVE		W. EXPIRATION		FISCAL YEAR	PRECEDING	0	0
X. NUMBER*		Y. AMOUNT		CURRENT	80	3.5	71
Z. KIND OF AWARD:		AA. CUM. AMT.		BB. PERFORMING ORGANIZATION		CC. NAME	
DD. RESPONSIBLE DOD ORGANIZATION		EE. ADDRESS		FF. PRINCIPAL INVESTIGATOR (Punish each if U.S. Academic Institution)		GG. NAME	
NAME: US Army Aeromedical Research Laboratory		ADDRESS: Fort Rucker, AL 36362		NAME: Johnson, J. C., CPT, MSC		NAME: US Army Aeromedical Research Lab Biodynamics Research Division	
RESPONSIBLE INDIVIDUAL		NAME: Knapp, Stanley C., COL, CDR		TELEPHONE: (205) 255-3211		ADDRESS: Fort Rucker, AL 36362	
TELEPHONE: (205) 255-5107		HH. GENERAL USE		JJ. SOCIAL SECURITY ACCOUNT NUMBER		KK. NAME	
NAME: Foreign Intelligence Considered		NAME: Behar, I., Ph.D.		NAME: Mozo, B. T., DAC		NAME: Johnson, J. C., CPT, MSC	
LL. KEYWORD (Proceed with Security Classification Code) (U) Vibration; (U) Noise; (U) Vestibular; (U) Bioengineering; (U) Acuity; (U) Stress; (U) Biodynamics; (U) Simulation; (U) Human							
MM. TECHNICAL OBJECTIVE,* NN. APPROACH, OO. PROGRESS (Punish individual paragraphs identified by number Proceed with Security Classification Code)							
23. (U) To assess the effect of whole-body, low-frequency vibration and noise peculiar to advanced combat vehicles on the human visual, cardiopulmonary, hearing, and musculoskeletal systems. Correlate these effects in relations to their relative hazards to acute or chronic injury potential and influence on crew performance, comfort, and efficiency. Develop health criteria recommendations for vehicle and subsystem design and operation.							
24. (U) The approach will be multidisciplinary in nature. Dynamic characteristics of the advanced combat vehicle technology program seat will be determined by Fourier transform techniques using instrumented human subjects on the USAARL multiaxis vibration table. Stress and fatigue reactions including neck muscle stress and fatigue associated with operation of video displays, target acquisition system, and head coupled vibration will be assessed by standard biochemical and psychophysiological as well as specialized electromyographic techniques. Dynamic visual acuity and eye fatigue will be studied under multiple conditions of target display, head and eye movement, and frequency phase controlled vibration, contrast, and luminance. Standard cardiopulmonary measurements will be made.							
25. (U) 7909-8009. Conduct of initial start-up work under reimbursement from the High Survivability Test Vehicle-Light (HSTV-L) program was used to validate the concept and need for this research. Work done in FY 80 shown under reimbursable projects.							
OO. Available to contractors upon originator's approval							
DD FORM 1 MAR 68 1498 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE DD FORMS 1498A 1 NOV 65 AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE							

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION#	2 DATE OF SUMMARY	REPORT CONTROL SYMBOL		
3 DATE PREV SUMMARY		4 KIND OF SUMMARY	5 SUMMARY SECY	6 WORK SECURITY	7 REGRADING	8 CHG'D INSTN	9 SPECIFIC DATA CONTRACTOR ACCESS	10 LEVEL OF SUM
		A. New	U	U	NA	NL	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
10 NO /CODES *		PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER	WORK UNIT NUMBER		
a. PRIMARY		6.27.77.A	3E162777A879		BH	163		
b. CONTRIBUTING								
c. <del>Contributing</del>		STOG 80 7.2:4						
11. TITLE (Pecode with Security Classification Code)* (U) Parametric, Multimodel Workload Assessment in Simulated Aircraft Guidance Systems								
12. SCIENTIFIC AND TECHNOLOGICAL AREAS 012900 Physiology; 009400 Man-Machine Relations; 013400 Psychology; 001300 Aircraft								
13. START DATE		14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY	16. PERFORMANCE METHOD			
80 10		83 12		DA	C. In-House			
17. CONTRACT/GRANT		EXPIRATION		18. RESOURCES ESTIMATE		19. PROFESSIONAL MAN YRS		20. FUNDS (In thousands)
a. DATES/EFFECTIVE				FISCAL YEAR	PRECEDING	CURRENT		
b. NUMBER *								
c. TYPE		d. AMOUNT						
e. KIND OF AWARD		f. CUM. AMT.						
21. RESPONSIBLE DOD ORGANIZATION		NAME: US Army Aeromedical Research Laboratory		22. PERFORMING ORGANIZATION		NAME: US Army Aeromedical Research Lab Biomedical Applications Research Div		
ADDRESS: Fort Rucker, AL 36362				ADDRESS: Fort Rucker, AL 36362				
RESPONSIBLE INDIVIDUAL		NAME: Knapp, Stanley C., COL, CDR		PRINCIPAL INVESTIGATOR (PUNISH SEAN II U.S. Academic Institution)		NAME: Schopper, A. W., Ph.D., MAJ, MSC		
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-3211				
23. GENERAL USE		SOCIAL SECURITY ACCOUNT NUMBER		ASSOCIATE INVESTIGATORS		NAME: Cote, D. A., 1LT, MSC		
Foreign Intelligence Considered				NAME:				
24. KEYWORDS (Pecode EACH with Security Classification Code) (U) Visual-Motor Performance; (U) Military Aircraft; (U) Workload; (U) Physiology; (U) Psychology								
25. TECHNICAL OBJECTIVE.* 26. APPROACH. 28. PROGRAMS (Punish individual paragraphs identified by number. Pecode last of each with Security Classification Code)								
<p>23. (U) The increasing levels of sophistication employed in the apparatus appearing in aviator cockpits and the increasing demands placed upon aviators have led to the recognition by both civilian and multinational military organizations (NATO) of the need to evaluate the workload, fatigue, and stress which is being placed upon aviators. Recent major literature reviews have yielded mixed results insofar as the existence of reliable and valid measures of these factors. The objective of this research is to programmatically evaluate existing and newly developed physiological and performance-related measures and identify those which are: (a) compatible with use during actual flight, (b) most sensitive to changes in actual workload, and (c) result in least interference with primary task performance.</p> <p>24. (U) As an analog to IFR flight, concomitant physiological measures of muscular, cardiovascular, thermal electroencephalographic, and eye movement activity will be obtained while programmed variations in aircraft control demands are presented to subjects via video displays and/or flight simulator instrumentation. Subjects will have to interactively respond with simulated aircraft controls (the primary task) to maintain simulated flight. The controls, themselves, will be programmed to make differing physical demands upon the operator. Simultaneously with such efforts, the operator will have the opportunity to respond to a variety of nonflight-related secondary tasks which, themselves, represent differing levels of perceptual and cognitive loads. In order that the study appropriately reflect the over-learned nature of actual flight performance, the study will be longitudinal in nature and involve a limited number of well-practiced subjects (3-6).</p>								
<p>25. (U) None</p> <p><small>*Subject to confirmation upon organization's approval</small></p>								
DD FORM 1498 1 MAR 68		PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 65 AND 1498 1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE						

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION#	2. DATE OF SUMMARY*	3. REPORT CONTROL SYMBOL
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY SECY	6. WORK SECURITY	7. REGRADING*	8. OWNER INSTRN	9. SPECIFIC DATA: CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
A. New	U	U		NA	NL	D. LEVEL OF DATA A. WORK UNIT
10. NO./CODES* PROGRAM ELEMENT				PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
A. PRIMARY	6.27.77.A	3E162777A879		BH	166	
B. CONTRIBUTING						
C. CONTRIBUTING						
11. TITLE (Proceed with Security Classification Code)* <b>(U) Anthropometric Criteria for Army Aviators</b>						
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <b>009400 Man-Machine Relationships; 012900 Physiology; 001300 Aircraft</b>						
13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD			
80 11	82 02	DA	C. In-House			
17. CONTRACT/GANT						
18. DATES/EFFECTIVE: EXPIRATION						
19. NUMBER:						
20. TYPE:						
21. AMOUNT:						
22. KIND OF AWARD:						
23. RESPONSIBLE DOD ORGANIZATION						
NAME: US Army Aeromedical Research Laboratory						
ADDRESS: Fort Rucker, AL 36362						
24. RESPONSIBLE INDIVIDUAL						
NAME: Knapp, Stanley C., COL, CDR						
TELEPHONE: (205) 255-5107						
25. GENERAL USE						
NAME: Foreign Intelligence Considered						
26. KEYWORD (Proceed with Security Classification Code)						
(U) Anthropometrics; (U) Aircraft; (U) Strength; (U) Aviation Medicine						
27. TECHNICAL OBJECTIVE; 28. APPROACH; 29. PROGRESS (Punish individual paragraphs identified by number. Proceed with Security Classification Code.)						
23. (U) The increased concern and emphasis upon the use of women in the US Army has resulted in the need to reevaluate the anthropometric criteria cited in AR 40-501 concerning Class 1, 1A, and 2 flying duty. Cockpit design criteria (MIL STD 1472 B) indicate that aircraft designers are to utilize dimensions corresponding to the 5th through the 95th percentile male. Standards cited in AR 40-501 are not consistent with these guidelines, and previously conducted research has indicated that personnel smaller than the 5th percentile male are capable of flying some Army aircraft. Hence, a need exists to reevaluate and modify, as appropriate, existent anthropometric criteria.						
24. (U) Dimensional analyses of US Army aircraft will be performed to include determinations of maximum control force requirements and weight and balance considerations. Anthropometric measurement, to include strength and weight dimensions, will be obtained from individuals (male and female) whose statures are less than 64 inches or greater than 73 inches. Data from these individuals will be compared with the cockpit-related data and individuals will be placed in aircraft to determine the static linear and anthropometric criteria. Weight criteria will be determined on the basis of its interrelationship with crash-survivability considerations, aircraft weight and balance considerations, and medical guidance regarding obesity. Strength criteria will be recommended after consideration of both maximal force requirements and the evaluation of sustained physical exertion upon cognitive and psychosensory capabilities while performing multi-element tracking tasks using aircraft controls which require varied levels of physical force input for their operation.						
25. (U) None.						
Available to contractors upon contractor's approval						
DD FORM 1 MAR 68 1498		PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 65 AND 1498 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE				

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION# DA OB 6889	2 DATE OF SUMMARY 80 10 01	REPORT CONTROL SYMBOL DD-DR&E(AR)636
3. DATE PREV SURVEY 79 10 01	4. KIND OF SUMMARY D. Change	5. SUMMARY SCRTY U	6. WORK SECURITY U	7. NEGATING# NA	8. DA DR&E INSTRN NL	9. SPECIFIC DATA- CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
10. NO./CODES: a. PRIMARY 6.11.02.A	PROGRAM ELEMENT 3M161102BS10	PROJECT NUMBER 3E161102BS07		TASK AREA NUMBER CR 00	WORK UNIT NUMBER 282 026	11. LEVEL OF DMS A. WORK UNIT
b. CONTRIBUTING 6.11.02.A						
c. COMPLEMENTARY STOG 80 7.2.1						
12. TITLE (Provide with Security Classification Code) (U) Military Acoustic Hazards: Mechanisms of Hearing Loss						
13. SCIENTIFIC AND TECHNOLOGICAL AREA 000200 Acoustics; 012400 Personnel Selection and Maintenance (medical): 007900 Industrial (occupational) Medicine						
14. START DATE 76 10	15. ESTIMATED COMPLETION DATE CONT	16. FUNDING AGENCY DA	17. PERFORMANCE METHOD C. In-House			
18. CONTRACT/GRAANT		19. RESOURCES ESTIMATE	20. PROFESSIONAL MAN YRS 3.9	21. FUNDS (in thousands) 241		
a. DATES/EFFECTIVE:	EXPIRATION	FISCAL YEAR 80	81	143		
b. NUMBER: c. TYPE: d. KIND OF AWARD:	e. AMOUNT: f. CUM. AMT.	CURRENT	SOCIAL SECURITY ACCOUNT NUMBER			
22. RESPONSIBLE DOD ORGANIZATION NAME: US Army Aeromedical Research Laboratory ADDRESS: Fort Rucker, Al 36362		23. PERFORMING ORGANIZATION NAME: US Army Aeromedical Research Lab Sensory Research Division ADDRESS: Fort Rucker, Al 36362 PRINCIPAL INVESTIGATOR (Provide EAN if U.S. Academic Institution) NAME: Patterson, James H., Ph.D. TELEPHONE: (205) 255-4408 SOCIAL SECURITY ACCOUNT NUMBER				
24. GENERAL USE Foreign Intelligence Considered		ASSOCIATE INVESTIGATORS NAME: Mozo, Ben T. NAME:				
25. REWORKS (Provide EACH with Security Classification Code) (U) Acoustics; (U)Personnel Selection and Maintenance (medical); (U)Industrial (occupational) Medicine; (U)Aircrafts; (U)Combat Vehicles; (U)Animals 26. TECHNICAL OBJECTIVE, 26 APPROACH, 26 PROGRESS (Provide individual paragraphs identified by number precede last of each with Security Classification Code)						
23. (U) To establish valid damage risk criteria to insure the adequate hearing protection of Army personnel exposed to continuous noise.						
24. (U) Behavioral, histological, and electrophysiological procedures are used with animal models and audiometric and psychophysical procedures are used with human subjects.						
25. (U) 7910-8009. During FY 80 three major studies using chinchillas were undertaken. These were the effects of 31.5 Hz octave band noise on hearing thresholds and histological injury, effects of 250 Hz octave band noise on hearing threshold and histological injury, a study of the role of peak pressure in the effects of impulse noise on hearing threshold and histological injury. Data analysis and report preparation are in progress. A study of the role of pigmentation in susceptibility to hearing loss was initiated using guinea pigs as subjects. Two exposures to 1.0 KHz octave band noise were completed. Data analysis and report preparation are in progress. A study to develop a method for determining the audiogram of the miniature swine was initiated. A training procedure was developed, however, a final procedure to produce an audiogram was not achieved.						
Available to contractors upon ordinator's approval						

DD FORM 1498  
1 MAR 68PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1488A 1 NOV 68  
AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION	2 DATE OF SUMMARY	REPORT CONTROL SYMBOL	
				DA OB 6886	80 10 01	DD-DRAE(AK)01	
3 DATE PREV SUM/FY	4 KIND OF SUMMARY	5 SUMMARY SECY	6 WORK SECURITY	7 REGADING	8 DA ORIGIN INSTRN	9 SPECIFIC DATA CONTRACTOR ACCESS	10 LEVEL OF DUR
79 10 01	D. Change	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A WORK UNIT
10 NO /CODES* PROGRAM ELEMENT				PROJECT NUMBER		TASK AREA NUMBER	
A PRIMARY 6.27.77-A				3E162777A878		AA	
B CONTRIBUTING 6.27.73.A				3E162773A819		00	
C FOREIGN EQUIPMENT STOG 80 7.2:4						050	
11. TITLE (Pecede with Security Classification Code)							
(U) Medical Assessment of Hearing Protective Devices							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS 000200 Acoustics; 013300 Protective Equipment; 007900 Industrial (occupational) Medicine							
13. START DATE 76 10	14. ESTIMATED COMPLETION DATE CONT			15. FUNDING AGENCY DA	16. PERFORMANCE METHOD C. In-House		
17. CONTRACT GRANT				18. RESOURCES ESTIMATE FISCAL YEAR CURREN			
A. DATES/EFFECTIVE EXPIRATION				B. PROFESSIONAL MAN YRS 2.1	B. FUNDS (In thousands) 169		
C. NUMBER C. AMOUNT				81	158		
D. KIND OF AWARD E. CUM. AMT.				19. PERFORMING ORGANIZATION NAME: US Army Aeromedical Research Laboratory ADDRESS: Fort Rucker, Al 36362			
20. RESPONSIBLE DOD ORGANIZATION NAME: Knapp, Stanley C., COL, CDR TELEPHONE: (205) 255-5107				21. PRINCIPAL INVESTIGATOR (Pecede each with Security Classification Code) NAME: Mozo, Ben T. TELEPHONE: (205) 255-4408 SOCIAL SECURITY ACCOUNT NUMBER			
22. GENERAL USE Foreign Intelligence Considered				23. ASSOCIATE INVESTIGATORS NAME: Goldstein, Jerod, MAJ(P) NAME: Camp, Robert T., Jr.			
24. KEYWORD (Pecede each with Security Classification Code) (U)Acoustics; (U) Protective Equipment; (U) Human; (U) Industrial (occupational) Medicine; (U) Aircraft; (U)Radio Communication;(U)Weapons Effects							
25. TECHNICAL OBJECTIVE* 26. APPROACH, 28. PROGRESS (Pecede individual paragraphs identified by number pecede last of each with Security Classification Code)							
23. (U) This research assesses the sound-attenuating characteristics of passive and active hearing protective devices, establishes their suitability to meet the needs of the Army, develops new hearing protective devices, determines laboratory and field techniques for evaluation, and investigates any associated medical affects on audiologic performance.							
24. (U) Methods utilized for the determination of the sound attenuation characteristics of hearing protective devices will be ANSI Z22.24-1957 and ASA STD 1-1975. Objective laboratory and field electroacoustic methods will also be used.							
25. (U) 7910-8009. The evaluation of the real ear attenuation characteristics of the SPH 4 manufactured by Aqua-Aire was completed. USAARL Report No. 80-6 "Attenuation Variation Obtained with Training When Utilizing an In-the-Ear Hearing Protective Device" was completed. USAARL Letter Report No. 80-9-2-3 "Real Ear Attenuation Characteristics of the DH-140 Helmet" was completed. Report is in progress on assessment of the real-ear attenuation and electroacoustic characteristics of three hearing protectors. These devices have potential use with artillery systems. Several muffs and ear-plugs were evaluated to determine potential for use in the Army environment. Development of a method to measure the sound attenuation characteristics of circumaural hearing protectors by physical method continues.							
Available to contractors upon originator's approval							
DD FORM 1498 1 MAR 68 PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE DD FORMS 1498A 1 NOV 68 AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE							

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION#	2. DATE OF SUMMARY <sup>a</sup>	REPORT CONTROL SYMBOL	
				DA OB 6893	80 10 01	DD-DR&E(AR)636	
3. DATE PREV SUMMARY	4. KIND OF SUMMARY	5. SUMMARY ACTY	6. WORK SECURITY	7. REGARDING	8. DRIVEN INSTAN	9. SPECIFIC DATA: CONTRACTOR ACCESS	10. LEVEL OF SUM A. WORK UNIT
79 10 01	D. Change	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A. WORK UNIT
10. MO /CODES <sup>b</sup> PROGRAM ELEMENT PROJECT NUMBER				TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	6.27.77.A	3E162777A879	BG		164		
b. CONTRIBUTING	6.27.73.A	3E162773A819	00		003/004		
c. <del>6.27.77.1/b/</del>	STOG 80 7.2:4						
11. TITLE (Provide with Security Classification Code)							
(U) Military Visual Problems: Assessment, Mechanisms, and Protection							
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>c</sup> 0012000 Optics; 012400 Personnel Selection and Maintenance; 012900 Physiology; 001300 Aircraft; 009400 Man-Machine Relations							
13. START DATE	14. ESTIMATED COMPLETION DATE		15. FUNDING AGENCY	16. PERFORMANCE METHOD			
76 10	CONT		DA	In-House			
17. CONTRACT/GRAANT				18. RESOURCES ESTIMATE			
19. DATES/EFFECTIVE: EXPIRATION:				20. PROFESSIONAL MAN YRS	21. FUNDS (in thousands)		
22. NUMBER <sup>d</sup>				FISCAL	4.9	105	
23. TYPE:				YEAR	80	504	
24. AMOUNT:				25. CUM. AMT.	81	6.0	
26. RESPONSIBLE DOD ORGANIZATION				27. PERFORMING ORGANIZATION			
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab Sensory Research Division			
ADDRESS: Fort Rucker, AL 36362				ADDRESS: Fort Rucker, AL 36362			
28. RESPONSIBLE INDIVIDUAL							
NAME: Knapp, Stanley C., COL, CDR TELEPHONE: (205) 255-5107							
29. GENERAL USE							
30. FOREIGN INTELLIGENCE CONSIDERED Foreign Intelligence Considered							
31. KEYWORD (Provide each with Security Classification Code) (U)Aircr Selection; (U)Optical/Ophthalmic Material; (U)Animal; (U)Photometry/Radiometry; (U)Man-Machine Compatibility; (U)Visual Performance; (U)Human							
32. TECHNICAL OBJECTIVE <sup>e</sup> , 33. APPROACH, 34. PROGRESS (Provide individual paragraphs identified by number. Provide last of each with Security Classification Code.)							
23. (U) The technical objectives are to develop methods for assessing potential visual problems created by military operational environments, to establish the underlying mechanisms of these visual problems, and to evaluate methods for protecting and enhancing visual performance. The data provided will impact: (a) crew selection and retention standards; (b) optimal visual performance criteria; (c) observer-display compatibility; (d) assessment of medical and non-medical material; (e) environmental factors including pharmacological; and (f) functional and organic visual problems.							
24. (U) The approach will include physical optics techniques of photometry, radiometry, and colorimetry; optics lab testing of distortion, prismatic deviation, power, transmittance, haze, neutrality, and resolution; psychophysical studies using human and animal observers; and neurophysiological studies using gross potential and single-cell recording							
25. (U) 7910-8009. Light control film was found effective in: (a) preventing the copilot from seeing reflections of his own instruments in his own side transparencies; and (b) preventing the pilot from seeing reflections of his own instrument panel in his own side transparencies. However, the film did not prevent the pilot from seeing reflections of the copilot's instrument panel. The work with the night vision goggle compatible lighting system demonstrated that the primary lighting system presently used in Army aircraft can, with modifications, be made compatible with the second generation night vision goggles. Needed modifications include: (1) the substitution of higher quality rheostats in the primary lighting controls; (2) the addition of a switch box to set the intensity of the warning, caution, and advisory lights at a daytime, nighttime naked eye, or nighttime night vision goggle level; (3) the addition of a balancing resistor to the altitude indicator; and (4) the use of a specially developed black paint in the cockpit to reduce reflections. Portions of the research from DAOB 6892, Research of Electro-Optical Systems and the Human Visual System, will be combined with and continued under this 1498.							
<sup>f</sup> Available to contractors upon originalator approval							

DD FORM 1498  
1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 68  
AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION NO.	2. DATE OF SUMMARY	REPORT CONTROL SYMBOL
3. DATE PREV SURVEY	4. KIND OF SUMMARY	5. SUMMARY ICYT <sup>a</sup>	6. WORK SECURITY	DA OG 0153	80 10 01	DD DR&E(AR)636
79 10 01	D. Change	U	U	NA	NL	
10. NO./CODES <sup>b</sup>				PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY				3E162777A879	BH	161
b. CONTRIBUTING				3E162773A819	00	001
c. Subsequent				STOG 80 7.2:4		
11. TITLE (Provide each with Security Classification Code <sup>c</sup> ) (U) Research Directed at Biomedical Parameters Affecting Aircrew Workload During Sustained Operations						
12. SCIENTIFIC AND TECHNOLOGICAL AREA <sup>d</sup> 013400 Psychology; 001300 Aircraft; 016200 Stress Physiology						
13. START DATE	14. ESTIMATED COMPLETION DATE	15. FUNDING AGENCY	16. PERFORMANCE METHOD			
78 10	CONT	DA	C. In-House			
17. CONTRACT/GRAANT				18. RESOURCES ESTIMATE		
a. DATES/EFFECTIVE:				PRECEDING	b. PROFESSIONAL MAN YRS	c. FUNDS (in thousands)
b. NUMBER:				FISCAL YEAR	80	252
c. TYPE:				CURRENT	8.9	
d. KIND OF AWARD:				81	3.8	335
e. RESPONSIBLE DOD ORGANIZATION				19. PERFORMING ORGANIZATION		
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab		
ADDRESS: Fort Rucker, AL 36362				ADDRESS: Biomedical Applications Research Div Fort Rucker, AL 36362		
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Provide name if U.S. Academic Institution)		
NAME: Knapp, Stanley C., COL, CDR				NAME: Stone, Lewis W., DAC		
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-3211		
20. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER		
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS		
21. REVISIONS (Provide each with Security Classification Code) (U) Man-Machine Relations; (U) Military Aircrafts; (U) Psychology; (U) Aviation Medicine; (U) Stress; (U) Sustained Operations; (U) Human Volunteers						
22. TECHNICAL OBJECTIVE <sup>e</sup> ; 23. APPROACH; 24. PROGRESS (Provide individual paragraphs identified by number. Provide each with Security Classification Code.)						
23. (U) Little is known about the medical problems which extended operations have on helicopter aircrews. The objective of this project is to assess the biomedical parameters which affect aviation personnel during sustained military operations. The overall results of the research will provide a baseline criteria for: (a) physiologic measures of workload, stress and fatigue; (b) the effect of workload, stress, and fatigue on extended performance; (c) Army aviation personnel requirements for sustained operations; and (d) the fatigue and stress effects caused by special operational equipment such as night vision goggles or helmet mounted sight systems.						
24. (U) The approach will involve the utilization of in-flight and simulator monitoring and recording systems capable of sampling and recording continuous analog and digital information in experiments designed to measure pilot performance and aircraft response. These recording systems and statistical techniques will be utilized to quantify and predict aviator performance levels and subsequent man-system efficiency as a function of extended military operations.						
25. (U) 7910-8009. During FY 80 data processing on the extended flight in the simulator study was started and is still in progress. Elements of the projects are in various stages of progressing and/or analysis. A proposed project entitle "The Effects of Extended Use of the AN/PVS-5 Night Vision Goggles on Helicopter Pilots" was accepted and completed through the data collection phase.						
Available to contractors upon originator's approval						

DD FORM 1498  
1 MAR 68

PREVIOUS EDITIONS OF THIS FORM ARE OBSOLETE. DD FORMS 1498A 1 NOV 68  
AND 1498 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1. AGENCY ACCESSION# DA OG 0156	2. DATE OF SUMMARY 80 10 01	REPORT CONTROL SYMBOL DD-DR&E(AR)636
3. DATE PREV SUMMARY 79 09 30	4. KIND OF SUMMARY D. Change	5. SUMMARY ACTY# U	6. WORK SECURITY# U	7. REGRADING# NA	8. DISCH'N INSTN# NL	9. SPECIFIC DATA- CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
10. MO./CODES: a. PRIMARY b. CONTRIBUTING c. <i>Local project hub</i>	PROGRAM ELEMENT 6.27.77.A 6.27.73.A STOG 80 7.2:4	PROJECT NUMBER 3E16277A879 3E162773A819	WORK UNIT NUMBER 162 010	9. LEVEL OF SUB A. WORK UNIT		
11. TITLE (Pecode with Security Classification Code) (U) Visual Performance Research Related to Operational Problems in Army Aviation						
12. SCIENTIFIC AND TECHNOLOGICAL AREAS 012900 Physiology; 009400 Man-Machine Relations; 013400 Psychology; 001300 Aircraft						
13. START DATE 78 10 01	14. ESTIMATED COMPLETION DATE CONT	15. FUNDING AGENCY DA	16. PERFORMANCE METHOD C. In-House			
17. CONTRACT/GANT	18. RESOURCES ESTIMATE FISCAL YEAR 80 81	19. PROFESSIONAL MAN YRS CURRENT 5.7 2.5	20. FUNDS (in thousands) 192 362			
21. DATES/EFFECTIVE: EXPIRATION:	21. PERFORMING ORGANIZATION NAME: US Army Aeromedical Research Lab Biomedical Applications Research Div ADDRESS: Fort Rucker, Al 36362					
22. NUMBER: 23. TYPE: 24. KIND OF AWARD:	22. PRINCIPAL INVESTIGATOR (Pecode if U.S. Academic Institution) NAME: Simmons, R. R., MS, DAC TELEPHONE (205) 255-3211 SOCIAL SECURITY ACCOUNT NUMBER ASSOCIATE INVESTIGATORS NAME: Kimball, K. A., Ph.D., DAC NAME: Stone, L. W., MA, DAC					
25. GENERAL USE Foreign Intelligence Considered	26. KEYWORD (Pecode EACH with Security Classification Code) (U) Visual Performance; (U) Binocular Vision; (U) Eye Movement; (U) Military Aircraft; (U) Man-Machine Relations; (U) Psychology; (U) Recording					
27. TECHNICAL OBJECTIVE, 28. APPROACH, 29. PROGRESS (Pecode individual paragraphs identified by number. Pecode last of each with Security Classification Code.)						
23. (U) Visual perception to Army aircrews is critical for pilotage, navigation, and weapon utilization to fulfill various tactical requirements. The objective of this project is to provide US Army aviation information regarding the visual performance of fixed and rotary wing aviators during varying tactical missions. Special emphasis will be placed on the objective quantification and interpretation of these data and their relation to variables such as pilot physiological and psychological states and task loading.						
24. (U) The approach will involve the utilization of an oculomotor monitoring and recording device for visual data collection during flight. Areas of research to be addressed will include: aviator visual performance during conditions of VFR, IFR, night, and nap-of-the-earth flights; day and night navigation; scout helicopter operations, and varying aircraft comparisons. Measurements of dwell times, scan rates, fixations, and zones of workload will be analyzed to provide visual performance criteria and models. Additionally, data collection equipment and techniques are being designed to provide the ability to record visual data under night flight conditions and data analyses project.						
25. (U) 7910-8009. Progress has been demonstrated by 5 progress summaries published in the <u>US Army Aviation Digest</u> . The computer base has been expanded to include the effects on aviation visual performance by aircraft stability, pilot currency, and pilot experience factors. Data from the computer base have been utilized to identify critical pilot visual requirements for a subminiature heads-up display concept. Current efforts are directed at expanding the computer base to include multipyschophysical and external stimuli efforts in aircrew visual performance/workload.						
26. Available to contractors upon original or major's approval						
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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION <sup>1</sup>	2 DATE OF SUMMARY <sup>2</sup>	REPORT CONTROL SYMBOL		
3 DATE PREV SURRY		4 KIND OF SUMMARY	5 SUMMARY SCRT <sup>3</sup>	6 WORK SECURITY	7 REGARDING <sup>4</sup>	8 DOD/N INSTRN	9 SPECIFIC DATA <sup>5</sup>	10 LEVEL OF SUB <sup>6</sup>
79 10 01		D. Change	U	U	NA	NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	A WORK UNIT
10 MO /CODES <sup>7</sup>		PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
B PRIMARY		6.27.71.A	3E16277A879		BH		165	
D CONTRIBUTING		6.27.73.A	3E162773A819		00		020	
C CONFIDENTIAL		STOG 80 7.2:4						
11. TITLE (Provide with Security Classification Code) (U) Aeromedical Research of Operationally Significant Problems in the Army Aviation Environment								
12. SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>8</sup>								
003500 Clinical Medicine; 012900 Physiology; 001300 Aircraft								
13. START DATE		14 ESTIMATED COMPLETION DATE		15 FUNDING AGENCY		16 PERFORMANCE METHOD		
78 10		CONT		DA		C. In-House		
17. CONTRACT GRANT								
18. DATES/EFFECTIVE		EXPIRATION		19. RESOURCES ESTIMATE		20. PROFESSIONAL MAN YRS		21. FUNDS (in thousands)
B. NUMBER <sup>9</sup>				PRECEDING		FISCAL		
C. TYPE				YEAR		YEAR		
D. KIND OF AWARD				80		6.4		154
				81		2.0		131
22. RESPONSIBLE DOD ORGANIZATION				23. PERFORMING ORGANIZATION				
NAME <sup>10</sup>		US Army Aeromedical Research Laboratory		NAME <sup>11</sup>		US Army Aeromedical Research Lab		
ADDRESS <sup>10</sup>		Fort Rucker, AL 36362		ADDRESS <sup>11</sup>		Biomedical Applications Research Div		
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (PUNISH SEAN IF U.S. Academic Institution)				
NAME: Knapp, Stanley C., COL, CDK				NAME: Kimball, K. A., Ph.D., DAC				
TELEPHONE (205) 255-5107				TELEPHONE (205) 255-3211				
24. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER				
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS				
				NAME: Duncan, C. E., MAJ, MSC				
				NAME: Stroud, J. P., CPT, MSC				
25. KEYWORDS (Provide each with Security Classification Code) (U) Stress; (U) Biomedical Evaluation; (U) Aircraft; (U) Psychology; (U) Recording Devices; (U) Human Volunteers; (U) Aviation Medicine								
26. TECHNICAL OBJECTIVE <sup>12</sup> ; 26. APPROACH; 26. PROGRESS (Punish individual paragraphs identified by number provide last of each with Security Classification Code.)								
23. (U) The objective of this project is to provide a definitive assessment of medical problems peculiar to the aviation environment and prepare guidelines for field commanders on the impact of these problems on the aviation mission. The results of such research will aid in development of improved standards and biomedical techniques for the field flight surgeon to use in monitoring and treating aviator stress and fatigue as well as the medical standards for selection of aviators and air traffic controllers for specific assignments.								
24. (U) A multidisciplinary approach, utilizing physiological measuring techniques, flight surgeon assessments, as well as aircraft comparisons, will provide the method to analyze aviator performance in the operational environment. Parameters to be measured will include heart rate, respiration, biochemical stress indices, and in-flight performance measurements.								
25. (U) 7910-8009. Progress has been demonstrated by responding to a request from The Surgeon General to develop a plan to minimize or eliminate compatibility problems between the night vision goggles (AN/PVS-5) and certain ametropic aviators; coordinating IHADSS helmet research on visor optics and transmissivity, bump protection, and acoustics protection; investigating new dark adaptometers for applicability both as a screen device and sensitivity determiner; performance of 118 prelaser exposure eye examinations.								
Available to contractors upon original or major approval								
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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION <sup>b</sup>	2 DATE OF SUMMARY <sup>b</sup>	REPORT CONTROL SYMBOL
3 DATE PREV SURY <sup>a</sup>	4 KIND OF SUMMARY	5 SUMMARY SCRT <sup>a</sup>	6 WORK SECURITY <sup>a</sup>	7 REGRADING <sup>b</sup>	8A DISCH INSTRN <sup>b</sup>	8B SPECIFIC DATA CONTRACTOR ACCESS <sup>b</sup>
79 10 01	D. CHANGE	U	U		NL	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
10 MO /CODES <sup>a</sup> PROGRAM ELEMENT				PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER
a. PRIMARY	6.11.02.A	3MI6T102BS10		CB	281	
b. <del>6.11.02.A</del>	6.27.72.A	3E162773A819		00	015	
c. <del>6.11.02.A</del>	STOG 80 7.24					
11. TITLE (Provide with Security Classification Code) <b>(U) Biodynamics of Impact Physiology</b>						
12. SCIENTIFIC AND TECHNOLOGICAL AREAS 001300 Aircraft; 002400 Bioengineering; 023300 Protective Equipment						
13. START DATE 66 12	14 ESTIMATED COMPLETION DATE CONT		15 FUNDING AGENCY DA	16 PERFORMANCE METHOD C. In-House		
17. CONTRACT/GRAANT				18 RESOURCES ESTIMATE FISCAL YEAR	19 PROFESSIONAL MAN-YRS CURRENT	20 FUNDS (in thousands) 187
21. DATES/EFFECTIVE: EXPIRATION				81	1.00	180
22. NUMBER: G. TYPE: H. KIND OF AWARD:				F. CUM. AMT.	23. PERFORMING ORGANIZATION NAME: US Army Aeromedical Research Laboratory ADDRESS: Fort Rucker, AL 36362	
24. RESPONSIBLE DOO ORGANIZATION NAME: US Army Aeromedical Research Laboratory ADDRESS: Fort Rucker, AL 36362				PRINCIPAL INVESTIGATOR /PHONE: NAME: U.S. Aeromedic Research NAME: Hader, James T. TELEPHONE: (205) 255-3001		
RESPONSIBLE INDIVIDUAL NAME: Knapp, Stanley C., COL, CDR TELEPHONE: (205) 255-3001				SOCIAL SECURITY ACCOUNT NUMBER ASSOCIATE INVESTIGATORS NAME: Shanahan, D. F., MAJ NAME: Hundley, Ted		
25. GENERAL USE Foreign Intelligence Considered						
26. KEYWORD (Provide each with Security Classification Code): (U) Helmet Testing; (U) Injury Prevention; (U) Protective Equipment; (U) Head Protection; (U) Bioengineering						
27. TECHNICAL OBJECTIVE <sup>a</sup> ; 28 APPROACH; 29 PROGRESS (Provide individual paragraphs identified by number. Provide rest of each with Security Classification Code). 23. (U) To provide valid, meaningful biomedical criteria for the development of improved design and equipment for head protection and means to assess helmet protective performance. Current helmet impact design and test methodologies are based on criteria developed 25 years ago. Epidemiological studies combined with impact analyses have shown that improved, lighter weight helmets can only be produced as new biomedical criteria are developed through the biomechanical evaluation of helmets. Through the improved medical protective impact performance of crew helmets preventable injuries can be minimized; thus, saving manpower and manhours that might be lost as a result of unnecessary injury. 24. (U) The approach will be based on sound and accepted experiment bioengineering methodologies including mathematical modeling, pathophysiologic techniques, biomechanics, structural engineering, and physics. 25. (U) 7909-8009. This work unit supports the Army's designated responsibility for direct head impact work for all three services. Charged to establish a biologically valid helmet impact test methodology. A major effort has begun to improve head protection in military aircraft accidents because 1 out of 3 aircraft crash fatalities is a result of head and/or neck trauma. In FY 80, the following tasks were completed: the thermal math model contract was completed and a paper summarizing the work was presented at the May 80 Aerospace Medical Association Annual Scientific Meeting; evaluations of helmet energy-absorbing foams and exterior shells continued and is 90% complete; an aviators head injury study was completed based on Safety Center and retrieved helmet data; and a draft USAARL report was completed summarizing the lessons learned from retrieved crash-damaged helmets. A paper entitled, "US Army Aircrewman Head-Neck Injury Experience, 1972-79" was presented at the Aerospace Medical Association Annual Scientific Meeting in May 1980. This 1498 submission represents a change in project title for alignment of this project with USAARL FY 81 Research Program.						

<sup>a</sup>Available to contractors upon ordinator's approval

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1 MAR 68

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AND 1498-1 1 MAR 68 (FOR ARMY USE) ARE OBSOLETE

RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION	2 DATE OF SUMMARY	REPORT CONTROL SYMBOL	
3 DATE PREV SUMMARY	4 KIND OF SUMMARY	5 SUMMARY ICY	6 WORK SECURITY	7 REGRADING	8 DISB'R INSTN	9 SPECIFIC DATA CONTRACTOR ACCESS	10 LEVEL OF SUB
79 10 01	D. Change	U	U	NA	NL	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
10 NO /CODES	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER	WORK UNIT NUMBER		
a. PRIMARY	6.27.77.A	3E16277A878		AF	133		
b. CONTRIBUTING	6.27.73.A	3E16277A819		00	014		
c. COMPTD BY	STOG 80 7.2.6						
11 TITLE (Provide with Security Classification Code)							
(U) Research Countermeasures for Significant Medical Hazards in Military Systems							
12 SCIENTIFIC AND TECHNOLOGICAL AREA <sup>8</sup> 006000 Escape, Rescue and Survivability; 002400 Bioengineering; 016200 Stress Physiology							
13 START DATE	14 ESTIMATED COMPLETION DATE		15 FUNDING AGENCY	16 PERFORMANCE METHOD			
78 10 01	CONT		DA	C. In-House			
17 CONTRACT GRANT			18 RESOURCES ESTIMATE	19 PROFESSIONAL MAN YRS		20 FUNDS (in thousands)	
b. DATES/EFFECTIVE	EXPIRATION		FISCAL YEAR	PRECEDING	2.4	110	
c. NUMBER			CURRENT	80			
c. TYPE				81	2.3	72	
e. KING OF AWARD	f. CUM. AMT.						
21 RESPONSIBLE DOD ORGANIZATION			22 PERFORMING ORGANIZATION				
NAME: US Army Aeromedical Research Laboratory			NAME: US Army Aeromedical Research Lab Biomedical Applications Research Div				
ADDRESS: Fort Rucker, Al 36362			ADDRESS: Fort Rucker, Al 36362				
RESPONSIBLE INDIVIDUAL			PRINCIPAL INVESTIGATOR (Provide Sean II U.S. Academic Institution)				
NAME: Knapp, S. C., COL, CDR			NAME: Knox, Francis S., Ph.D., DAC				
TELEPHONE:			TELEPHONE: (205) 255-3211				
23. GENERAL USE			SOCIAL SECURITY ACCOUNT NUMBER				
Foreign Intelligence Considered			NAME: Stroud, J. P., CPT, MSC				
24. KEYWORD (Provide EACH with Security Classification Code)			NAME: Nagel, G. A., CPT, MSC				
(U) Hazards; (U) Protective Equipment; (U) Stress Physiology; (U) Life Support; (U) Bioengineering; (U) Biochemistry							
25. TECHNICAL OBJECTIVE, 26. APPROACH, 28. PROGRESS (Purush individual paragraphs identified by number. Provide rest of each with Security Classification Code.)							
23. (U) Conduct applied medical research to identify, assess and prevent unnecessary health hazards and personnel injuries imposed by exposure to the operational environment toxic gasses, oxygen levels, chemical and biological agents, and to provide the Army technical information, recommendations and standards to be used in the development and modification of systems that provide protection from those hazards.							
24. (U) The approach involves the application of physiological and biomedical applied research methods utilizing physical examinations, x-rays, and biochemical analysis techniques to isolate the hazards involved and determine required protective measures. These techniques will be applied to the establishment of biomedical requirements of environmental control systems and oxygen generating systems, life support survival equipment and aeromedical evacuation and rescue equipment.							
25. (U) 7910-8009. Analysis of data on the acceleration/deceleration impact hazard assessment of ground combat vehicles and establishment of impact test criteria and methodology for the new combat vehicle crewman protective helmet is complete and reported in USAARL LR-80-8-3-5. A draft test plan for the assessment of the medical hazards and operational constraints associated with the use of NBC protective clothing has been written. Clothing has been procured and an in-flight physiological monitoring system has been ordered. Tri-service and Tri-nation (US, Canada, UK) coordination has occurred. Modifications of objectives and approach reflect changes in assignment of investigative personnel.							
Available to contractors upon originalors approval							
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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION	2 DATE OF SUMMARY	REPORT CONTROL SYMBOL	
				DA OG 0169	80 10 01	DD DR&E(AR)656	
3 DATE PREV. SUMMARY	4 KIND OF SUMMARY	5 SUMMARY SECY	6 WORK SECURITY	7 REGADING	8A DIES'N INSTRN	8B SPECIFIC DATA	9 LEVEL OF SUM
79 09 30	D. Change	U	U	NA	NL	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
10 NO CODES	PROGRAM ELEMENT	PROJECT NUMBER		TASK AREA NUMBER		WORK UNIT NUMBER	
a. PRIMARY	6.27.77.A	3E162777A878		AF		134	
b. CONTRIBUTING	6.27.73.A	3E162773A819		00		047	
c. Secondary	STOG 80 7.2.4						
11 TITLE (Pecode with Security Classification Code) (U) Biomedical Application and Health Hazard Assessment of Oxygen Enrichment Breathing Systems							
12 SCIENTIFIC AND TECHNOLOGICAL AREAS <sup>8</sup>							
016200 Stress Physiology; 008800 Life Support; 001300 Aircraft							
13 START DATE	14 ESTIMATED COMPLETION DATE	15 FUNDING AGENCY	16 PERFORMANCE METHOD				
79 05	80 09	DA	C. In-House				
17 CONTRACT GRANT				18 RESOURCES ESTIMATE			
a. DATES/EFFECTIVE	EXPIRATION			FISCAL	PRECEDING	B. PROFESSIONAL MAN YRS	D. FUNDS (in thousands)
b. NUMBER				YEAR	80	2.0	66
c. TYPE	d. AMOUNT				81	2.5	115
e. KIND OF AWARD	f. CUM. AMT.			19. RESPONSIBLE DOD ORGANIZATION			
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab			
ADDRESS: Fort Rucker, Al 36362				ADDRESS: Biomedical Applications Research Div Fort Rucker, Al 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Pecode 82AN if U.S. Academic Institution)			
NAME: Knapp, Stanley C., COL, CDR				NAME: Knox, Francis S., Ph.D., DAC			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255- 3211			
21. GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
Foreign Intelligence Considered				NAME: Hiott, B. F., MSgt, USAF			
22. KEYWORD (Pecode EACH with Security Classification Code) (U) Oxygen Supply Equipment; (U) Life Support; (U) Stress Physiology; (U) Aircraft; (U) Toxicology				NAME: Kessler, J. B., CPT, MC			
23. TECHNICAL OBJECTIVE, 24 APPROACH, 25 PROGRESS (Pecode individual paragraphs identified by number Pecode last of each WIR Security Classification Code.)							
23. (U) To identify, assess, and prevent unnecessary health hazards associated with the flight environment and to obtain a biomedical data base on the human function associated with the use of aircraft oxygen enrichment breathing systems in the flight environment. To provide the Army data, information, recommendations and criteria to aid in the development and deployment of life support systems to alleviate identified health hazards.							
24. (U) The approach will consist of a biomedical evaluation of state-of-the-art oxygen enrichment breathing systems during aircraft ground and flight conditions. The evaluation will include the sampling of the environmental air input to the system as well as the system output enriched air. The samples will be analyzed to determine the systems' ability to effectively filter contaminants known to exist in the operational environment. Physiological data, heart rate, oxygen tension and respiratory functions as well as system parameters, oxygen concentration, flow rates, temperatures and pressures will be collected during ground operations and aircraft flight at altitude to assess the ability of the system to provide aviators the required oxygen concentration and purity during various flight profiles. The data collected will be evaluated with respect to biomedical, safety, and man/machine limitations.							
25. (U) 7910-8009. The test plan for the biomedical evaluation of two state-of-the-art molecular sieve oxygen generating systems has received human use approval. Initial altitude chamber tests are complete and a report is in preparation. Steady state flight tests await recalibration of an IR Spectrophotometer. Flights to calibrate and validate the data acquisition system in the air continue to occur. Early results have been reported in Letter Report 80-10-3-6 and at the Aerospace Medical Association Annual Meeting and at a Tri-national (US, Canada, UK) Tri-service Conference.							

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RESEARCH AND TECHNOLOGY WORK UNIT SUMMARY				1 AGENCY ACCESSION <sup>2</sup>	2 DATE OF SUMMARY <sup>3</sup>	REPORT CONTROL SYMBOL	
3 DATE PREV SUMMARY 79 10 01	4 KIND OF SUMMARY D. CHANGE	5 SUMMARY SCRTY <sup>4</sup> U	6 WORK SECURITY <sup>5</sup> U	7 REGADING <sup>6</sup>	8 DISB'N INSTRN <sup>7</sup> NL	9 SPECIFIC DATA CONTRACTOR ACCESS <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
						10 LEVEL OF SUB-A WORK UNIT	
10 NO /CODES <sup>8</sup> PROGRAM ELEMENT				PROJECT NUMBER	TASK AREA NUMBER	WORK UNIT NUMBER	
A. PRIMARY 6.27.77.A	3E162777A878			AG	131		
B. CONFIDENTIAL/REF/6/	6.27.72.A			00			
C. CONFIDENTIAL/REF/6/	STOC 80 7.2.4				013		
11 TITLE (Punctuate with Security Classification Code) (U) Biodynamics of Life Support Equipment and Personnel Armor							
12 SCIENTIFIC AND TECHNOLOGICAL AREAS 008800 Life Support; 016200 Stress Physiology; 002400 Bioengineering							
13 START DATE 78 10	14 ESTIMATED COMPLETION DATE CONT			15 FUNDING AGENCY DA	16 PERFORMANCE METHOD C. In-House		
17 CONTRACT/GANT				18 RESOURCES ESTIMATE	19 PROFESSIONAL MAN YRS	20 FUNDS (In thousands)	
A. DATES/EFFECTIVE:	EXPIRATION			FISCAL YEAR	80	5.8	137
B. NUMBER <sup>9</sup>				CURRENT			
C. TYPE:	4. AMOUNT			81	3.0	101	
D. KIND OF AWARD:	5. CUM. AMT.						
21 RESPONSIBLE DOD ORGANIZATION				22 PERFORMING ORGANIZATION			
NAME: US Army Aeromedical Research Laboratory				NAME: US Army Aeromedical Research Lab Biodynamics Research Division			
ADDRESS: Fort Rucker, AL 36362				ADDRESS: Fort Rucker, AL 36362			
RESPONSIBLE INDIVIDUAL				PRINCIPAL INVESTIGATOR (Punctuate SNAME // U.S. Academic Institution)			
NAME: Knap, Stanley C., COL, CDR				NAME: Shanahan, D. F., MAJ			
TELEPHONE: (205) 255-5107				TELEPHONE: (205) 255-3001			
23 GENERAL USE				SOCIAL SECURITY ACCOUNT NUMBER			
Foreign Intelligence Considered				ASSOCIATE INVESTIGATORS			
24 KEYWORDS (Punctuate EACH with Security Classification Code) (U) Protective Equipment, (U) Stress Physiology, (U) Musculoskeletal Systems; (U) Biomedical; (U) Man-Machine Relationships				NAME: Hundley, T. A., BA, DAC NAME: Johnson, Gerald, SFC			
25 TECHNICAL OBJECTIVE, 26 APPROACH, 28 PROGRESS (Punctuate individual paragraphs identified by number. Punctuate last of each with Security Classification Code)							
23. (U) To provide a technological data base concerning the physiological and biomedical aspects of the evaluation and injury correlation of life support equipment, identification of hazard protection problems associated with life support equipment and to provide conceptual design recommendations and criteria for the improvement of life support equipment. Data derived from the retrieval and analysis of life support equipment is utilized to identify conditions under which individual items of life support equipment fail to provide protection from injury. Such information is necessary to provide the basis for recommending changes in medical design criteria. The goal of this program is to reduce the number and severity of injuries in aviation mishaps through the acquisition of better life support equipment.							
24. (U) Army aviation life support equipment involved in either injury causation or prevention, in the field, are sent to USAARL for biomedical and injury correlation evaluation. This evaluation assesses the effectiveness/deficiencies of the life support equipment through an analysis of the physical condition of the protective devices, the human injury incurred and the related human dynamics involved in the accident. The analysis is accomplished by the application of epidemiologic methods incorporating medically related engineering failure mode analysis, accident investigative procedures, forensic pathology, mathematical modeling and applied bioengineering research techniques.							
25. (U) 7909-8009. A report summarizing helmet damage and resulting injuries is being written. This report will provide supporting rationale for proposed requirements for future flight helmets. In accordance with the letters of agreement concerning life support equipment evaluation, we evaluated 2 helmets from the Air Force and 3 helmets from the Navy. Evaluation letter reports on helmet performance were provided to appropriate Air Force and Navy personnel. This 1498 submission represents a change in project title for alignment of this project with USAARL FY 81 Research Program.							
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Commander US Army Aviation R&D Command ATTN: DRDAV-E P.O. Box 20 St. Louis, MO 63166	(1)	US Air Force Flight Test Center Technical Library, Stop 238 Edwards AFB, CA 93523 (1)
Director US Army Human Engineering Laboratory ATTN: Technical Library Aberdeen Proving Ground, MD 21005	(1)	US Air Force Armament Development & Test Center Technical Library Eglin AFB, FL 32542 (1)
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